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MODERN MEDICINE

AND

SOME MODERN REMEDIES

THOMAS BODLEY SCOTT

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PRACTICAL NOTES FOR THE GENERAL PRACTITIONER

BY

THOMAS BODLEY SCOTT

AUTHOR OF "THE ROAD TO A HEALTHY OLD AGE"

WITH A PREFACE

BY

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AUTHOR'S APOLOGY

THE "Horæ Subsecivæ" of a busy doctor are not many, nor are they consecutive. If one could sit down at one's leisure and write *currente calamo*, a more finished and better thought-out argument could be produced, but one not necessarily more convincing. For these essays, which have been written at odd times and in odd places, I know I can claim the forbearance and sympathy of my professional brethren, for they too are the servants—thank God the willing servants—of their patients night and day.

T. B. SCOTT.

BOURNEMOUTH,
February 1916.

PREFACE

When the library of Louvain with its precious books and priceless manuscripts was destroyed in August 1914, in the name of their god "Kultur" by the modern Huns, more treacherous, more unspeakably mean and more incredibly evil, than their prototypes, a cry of horror and execration rose from the civilized world. For this was not only an outrage on Belgium, a country which the Huns had pledged themselves to respect; it was a crime against humanity—for the treasures of learning then destroyed were a part of the heritage of mankind. Great and widespread was the lamentation, and cause enough there was for it, for these lost treasures can never be entirely replaced. Yet we see every day around us a loss of learning going on greater than occurred in the destruction of Louvain, and no one seems to perceive it or lift a finger to prevent it. No doubt some men outlive their usefulness, but many die

just when they are at their best, just when they have accumulated stores of wisdom and have learned both what to do and how to do it. Most of these men carry their knowledge and power with them to the grave, and leave no record behind them by which posterity might profit.

In former days this complete loss was prevented to a great extent by the system of apprenticeship. By this system a master imparted to his apprentices as much as he could of the secrets of his craft, and ensured as much as possible that the best methods he had learned from his own master, or discovered for himself, should be transmitted in full measure to his pupils, who in their turn should do as much for theirs.

But this system with all its advantages has in great measure disappeared, and serious has been the loss.

Perhaps no art or craft has suffered more than that of medicine by this change. It is true that the loss has been compensated, and more than compensated on the whole, by the enormous advances of medical science. Our knowledge of the causes of disease, our power to recognize their presence, and our knowledge

of the action of drugs, have increased so enormously within the last fifty years that medicine may now almost boast of being an exact science.

But while medicine as a science has gained, there has been loss in medicine as an art—loss in the method of applying all this knowledge to the treatment of individual patients. One man may know theoretically all about the laws of perspective and the harmony of colours, and yet be unable to produce anything but a daub, while another who is completely ignorant theoretically may be able to paint a charming picture. In like manner a man may be able to pass the most stringent examination with honours in pathology, pharmacology and diagnosis, yet he may prove almost useless by the bedside, because he tries to treat the disease, and not the patient. On the other hand a man with far less theoretical knowledge but more common sense and *savoir-faire* will win his patient's confidence, give him comfort and ease both of mind and body, and even rescue him from a condition so serious as to be well-nigh hopeless.

The ideal physician is the man who combines theoretical knowledge, practical experience and

savoir-faire. In the absence of apprenticeship the best conditions for obtaining this highly desirable combination are those of a general practitioner who, after a thorough training as a student, has an active practice amongst patients sufficiently wealthy to enable him to call the best specialist or specialists into consultation in any difficult case. He thus learns all they can teach him either of theory or practice, he has an opportunity of testing the correctness of both by watching the progress of his patient, and from his relations with the sick person he becomes a friend both of the patient and the family.

It is most unfortunate that such men rarely write down the results of their experience, for they are too much engaged in their daily work while they are in practice, and instead of retiring early, so as to have a few years' leisure before they die, they are apt to work to the very last and die in harness.

It is a most welcome occurrence when a man fully qualified to do so writes down the ripe experience of his life so as to help his fellow-workers, both general practitioners and consultants, who one and all may learn from him.

I feel myself much honoured by the request of my friend Dr. T. B. Scott to write a preface to his book, and in doing this I gladly acknowledge myself to be one of the consultants of whom I have just spoken, and to thank him for the knowledge I have gained from reading his book.

Few, if any, will rise from its perusal without knowing something of which they were previously ignorant; and if other men qualified like Dr. Scott will follow the example he has set, and write down the results of their experience, the medical profession will gain greatly in knowledge and patients will benefit greatly by improvement in treatment.

LAUDER BRUNTON.

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ESSAYS ON PRACTICAL MEDICINE

INTRODUCTION

The experiences and opportunities for experiences that belong to hospital physicians and to general practitioners differ so much, that the study and treatment of disease from their several points of view differ also. As a rule the hospital physician is an able writer and a skilled recorder, while the general practitioner has either not the time, or else not the courage, to record his experiences and results, and so much valuable material and knowledge are lost to the world. A great general will take care to get into touch with his non-commissioned officers and men, as well as with his officers, and will make use of the experiences and observations of both classes. Not a few of our own wiser hospital physicians refuse to sit in the seat of the scornful, and listen carefully to what we have to say and openly acknowledge their in-

debtedness to us. It has been too much the habit of our profession to rely almost entirely on hospital records and results, both of which are necessarily obtained under rather abnormal and favourable circumstances, and it is difficult for the ordinary hospital physicians to gauge the difficulties in diagnosis, in prognosis, and in treatment that meet their humbler brethren.

Dr. James Mackenzie in his invaluable work on diseases of the heart says: "The investigators in hospital wards and laboratories have little idea of the difficulties the general practitioner has to encounter. He must ever be on the alert, prepared to make an observation at any hour of the day and night; attacks of illness which may arise suddenly must find him prepared to take advantage of his opportunities." He goes on to say, "The little I have been able to do in this respect has but opened my eyes to the extraordinarily rich field for investigation that lies before the general practitioner."

The position that Dr. Mackenzie has won for himself and the magnificent work he has done, though for years only a general practitioner, should be a great encouragement and incentive to us all.

Why, then, should we keep our lights hidden?

Our light, like that of true religion, is meant to shine before men, and to enable both them and us to glorify our Father which is in heaven. Our work, if faithfully done, will surely lead towards the fulfilment of His increasing purpose, which I take to be the evolution of human perfection.

We have some good periodicals that are ready to accept any papers of merit and originality. It is we who see disease in its inception, in its maturity and in its end. We may not have the scientific knowledge and appliances that belong to a well-equipped hospital, but in our knowledge of practical therapeutics we are often in advance of the hospital physician: that this should be so is no honour to us, and no shame to them, for we are in much closer relationship with our patients, and we can observe more accurately the successes and the failures of our methods. We have to treat disease in its natural habitation and surroundings, and not in the unaccustomed quiet and luxury of a hospital ward. As our difficulties are greater, so must we improve our weapons and resources. Our teachers and examiners are devoted, hard-working, excellent men, and good doctors up to their lights, but

they have, from the very nature of their position, their limitations.

I think perhaps where we are most deficient is in accuracy of diagnosis. Sometimes we are hurried, and often wearied, and so come to a conclusion too hastily; sometimes we have to use the stethoscope in such noisy rooms that important points are missed or misread. Whether this be so or not, accuracy of diagnosis must be the groundwork of success. This may entail more time and trouble than we seem to have to spare, but it is so essential that in the end no time will have been lost. We must not hesitate to call in other aids, especially the aid of the bacteriologist and in some cases that of the specialist. A wise general practitioner who had a very large club and contract practice once said, "The only way to make contract practice pay is to find out what is really the matter with your patients, give them the best medicines you know, even if they be costly, and get them off your list as quickly as possible." That contains not only worldly wisdom, but the true spirit also of altruism and righteousness. Good and honest work will always pay in the end. These thoughts must lead us on to see the enormous importance of a sound knowledge of

therapeutics; for mere accuracy of diagnosis is, as I have said before, only the groundwork, the foundation of our successful building. Our one and only objective must be, to cure disease, and in so doing to relieve suffering and prolong life. In the great campaign against disease, we should be the eyes and ears of the army; the scouts, and in treatment often the pioneers.

We should welcome the wisdom that comes from above, from our teachers and lecturers, but we should not be enslaved by it; we should rather prove it and improve it.

Failures must of course come to us, but we should never allow ourselves to look on failure as inevitable. We must storm and go on storming even what seem to be impossible heights.

I publish this little book in the hope that it may be of some help to my fellow practitioners, and still more in the hope that it may induce some of them to follow my poor example.

I

DISORDERS OF THE HEART

If there is one organ of the body that we are tempted to misread more than another it is, I think, the heart. We are so tied down by traditions and conventions with regard to heart affections that we hardly ever give our common sense full play. And it is not only in conditions of evident disease that we misinterpret, but also in conditions of apparent health. One chief reason for our errors is, I think, the exclusive reliance on the stethoscope. In reality the stethoscope tells us but a small part of the whole matter. It tells us the condition of the valves of the heart, and this is, of course, a thing we must know; but, except in cases of extreme debility or degeneration, it tells us very little of the state of the muscle of the heart itself, that great driving-power that keeps going our circulation, and with it our life, and to which the valves are only accessories.

As a preliminary to the intelligent study of heart disease we must get these axioms firmly into our minds: first that the heart is an organ with enormous natural powers of recuperation, and second that it is an organ with a marvellous power of adapting itself to meet not only emergencies, but also permanently altered conditions. We must all of us have come across many cases in our lives, in which there was marked valvular abnormality, yet in which no symptoms of ordinary heart disease showed themselves during life. I think the loudest aortic systolic murmur I ever heard was in an old lady, who with the exception of rheumatism had remarkably good health and who lived till she was ninety-three.

To give very shortly a clear idea of the functions and special characteristics of the heart muscle I give this extract from Dr. Mackenzie's book on diseases of the heart: "I therefore suggest as a working hypothesis, that, in the evolution of the heart muscle fibres, certain functions of the primitive cell were retained, some of these being more developed than others according to the duties the fibres had to perform, so that while they have come to resemble muscle fibres, they never-

theless retain, in a varying degree, some functions which are highly specialised in the nerve cell."

The special functions which Gaskell has demonstrated are five:

1. The power of producing a stimulus which can excite the heart to contract	Stimulus production
2. The power of being able to receive a stimulus	Excitability
3. The power of conveying a stimulus from fibre to fibre . .	Conductivity
4. The power of contracting, when stimulated	Contractibility
5. The power to retain a certain amount of contraction even when the activity has ceased .	Tonicity

For the elaboration and description of these five functions, which all go to form the perfect action and function of the heart, I must refer my readers to Dr. Mackenzie's book, or to Gaskell's article on "The contraction of the heart muscle" in Schäfer's text-book of physiology. Without this physiological explanation and knowledge it is difficult, nay impossible, to rightly weigh the value of abnormalities in the heart's action in clinical work.

The relative importance of different valvular diseases varies, without doubt; but that is a

point which I shall touch on later. My contention is this: that the man who in heart affections trusts only to the stethoscope is, of necessity, sure to come to grief, for he is gauging one side only, and that not the most important side, of a complicated problem. The test of a heart's working power lies not in the perfection of this or that valve, but in the fact of that heart being able to meet the demand of the individual's life or not; and in testing this the stethoscope will help but little. Careful observation of the patient's breathing and powers of endurance will help, far more, to show what amount of reserve power remains in the heart muscle and what the prospects are of that muscle being able to respond to new demands.

For further guidance—and I think it would be hard to exaggerate their value—we have the sphygmograph and the syphygmo-manometer (I am not laying stress on the electro-cardiograph, as that is practically out of the reach of the ordinary doctor); these will help far more than the stethoscope to get a clear and just understanding of the heart's condition. It is very rarely, for example, that the "pulsus alternans," which may be of great diagnostic

importance, can be detected by the finger; the sphygmograph alone can prove its existence. Arterial tension again, high or low, can only be at all accurately tested by the manometer, and in the treatment of a failing heart, of what paramount importance it is to recognise the true condition! To learn the use of these instruments takes some time and trouble, but it is our manifest duty to do it. When we are able to use them we shall be able to do far more for our patients, for our reputation, and for our peace of mind. Nothing is more unsatisfactory to an honest mind, than to feel that he is trying to solve a problem, which is insoluble, only because of the twilight ignorance of his own mind, or of the imperfection of his weapons. In general practice, especially among busy working folk, these cases of heart disease or heart failure form a large part of our practice, and their continuance leads to much disability and misery. If we can get hold of them in their early stages and treat them wisely, we can do very much not alone to prolong life but to maintain a good output of work, and what that means to working people those only who have lived among them know. Let us then cast aside our old preconceived ideas, which were

often not in accordance either with knowledge or with experience, and using every weapon of modern science, let us wage a new warfare in the spirit of confidence and hope. Many of our older teachers and brethren will quietly sneer, and throw cold water on our enterprises, but we must comfort ourselves with the thought that the old proverb about putting new wine into old wine-skins still holds good.

In the study and treatment of heart diseases we must most strongly bear in mind the fact that the natural heart under ordinary conditions is only working at part of its power, and that there is always a considerable reserve of latent force. This varies of course, in different individuals, and in the same individual under different circumstances. It is this latent force that enables us in health to make unusual and prolonged physical efforts, and it is the greater or lesser amount of this latent force that enables the heart under conditions of disease to meet and overcome the new difficulties, or to fail in the attempt. In health, by wise physical exercises, and by what we call training, the latent force can be enormously increased, so that marvellous feats of effort and endurance can be performed. In disease also the amount

of latent force can be much increased or at least preserved by wise exercise and training. This we see constantly as the result of the so-called Swedish exercises and of those of Nauheim. With these facts firmly in our minds, we must approach each case of heart disease not so much from the valvular side, the side of obstruction or of leakage, as from the side of the heart muscle itself. The stethoscope will tell us more or less accurately the nature of the valvular defect, but not—which is more important—the power of the great and complicated organ to meet that defect.

We must study the whole problem in a large spirit, and our treatment must be directed to placing the patient and his heart under the best conditions for recovery, or, if that be not possible, for a natural readjustment of the heart's work. Many a heart will do this for itself if it only has the chance. Rest, it goes without saying, must be the first step, but to rest a heart is not quite so simple an affair as resting a limb. Staying in bed, or in the recumbent position, is of course good up to a certain point; but the heart has to go on working and pumping the blood unceasingly, and it often can do this better if the patient change the position from

time to time. If by rest in one position the lungs get into a state of hypostatic congestion, the right ventricle has extra work to do and the balance of the whole cardiac and respiratory system gets upset. Stagnation of the portal circulation will soon add another difficulty: comparative, not complete, rest is all one can give the heart, and to give that in the best way common sense and individual observation must be largely used. We all know how a patient with cardiac dyspnœa longs to change his position from time to time, and Nature no doubt tells him aright. The great things to avoid in such a case are hurry and straining; stooping to pick up something, or to lace boots, will often bring on acute distress. The physician can help this heart to get rest considerably by removing obstructions to the circulation of blood, by keeping the portal circulation free, and by encouraging the thorough action of the bowels and kidneys. It is marvellous to see a tired, overworked and failing heart coming back to efficiency and comfort under the famous old pill, which both Guy's and St. Bartholomew's claim, of mercury, squills and digitalis: the mercury steadily stimulates the liver, and the squill and digitalis both act on heart and

kidneys. Experience has often shown that digitalis without the mercury is almost useless in such a case. If again by the modern methods of testing the arterial resistance—viz. by the sphygmo-manometer—we find, as we so frequently do, that there is high blood-pressure, we can help the heart greatly by reducing that pressure, and with it the peripheral resistance to the flow of arterial blood. After two or three weeks of such intelligent rest treatment, one will be able to form a far better idea of the real state of the heart; one will know how much true valvular trouble exists, how much of the trouble was due to dilatation, and how much to the state of the heart muscle itself.

One speaks of these conditions, valvular disease, dilatation and muscular weakness, as separate, but as a rule they are all three bound up together and are interdependent. To arrive at this knowledge one must, besides using the stethoscope, observe carefully the position of the heart's apex and the area of cardiac dullness. If the murmur cease or lessen in intensity, if the dullness diminish and the apex-beat come gradually back to its normal position, one will reasonably hope that the heart's disorder was due chiefly to exhaustion of a temporary nature,

and that it possesses a fair amount of reserve power. If, on the other hand, the murmur remain the same, and the dullness and apex-beat remain stationary, one will realise that the heart's condition is probably due to permanent dilatation, or to compensatory hypertrophy, following a long-standing valvular disease; here the history of the patient, his former illnesses and his habits of life will help towards an accurate diagnosis. If the condition is one of hypertrophy and old valvular disease, not much can be done by treatment, except to keep up the nutrition and strength of the heart muscle—we must never forget that hypertrophied muscles are particularly liable to degenerate—iron, arsenic and strychnine, particularly in combination, will help much towards this end. Such hearts, if carefully nursed, will often last a long time, but they have to live their life at a rather low level. The old proverb says, the strength of a chain is the strength of its weakest link, and such patients have to learn this lesson and to order their work and energies in accordance with their weak link.

On the other hand, one must never discourage these cases. A leaky ship will often make a long and successful voyage, and a heart with a leaky

valve will often carry its owner to old age, and will help him to do much excellent work. If you tell such a man that he has incurable heart disease (he may happily be blessed with a saving scepticism), you will have done your utmost to ensure the accuracy of your prognosis, though your diagnosis may have been grievously wrong. There is no important organ of the body so susceptible to nervous and mental influence as the heart; hope will buoy it up to make renewed and often successful efforts, despair will kill it. To support my contention I quote Dr. James Mackenzie's words: "Let it always be remembered that frequently sound and healthy hearts show a murmur, and that it is necessary therefore to seek for other evidences on which to base a prognosis. The heart failure which may be present depends upon so many and so varied conditions—as, the extent of the valvular lesion, its progressive nature depending on the cicatrising process affecting the valves, the coincident changes in the muscle and in the auriculo-ventricular bundle, the condition of life of the individual—that no rule applicable to all cases can be made." Later on he says: "Let no single symptom be the ground for

forming an unfavourable prognosis. In this respect, the presence of a murmur has so oppressed the profession that a vast amount of positive harm is continually being done to patients by taking too seriously the prognostic significance of this sign. The field of cardiac response is the only true and safe guide in these cases. Even if for the time being that response is limited, judgment should be suspended until an opportunity has been obtained for ascertaining to what extent the heart muscle can regain a store of reserve force." The business of a prophet is nearly at all times a dangerous and an unsatisfactory one, whether in medicine or in any other sphere; but, recognising our fallibility, it is surely wiser and safer to err, like Balaam of old, on the side of blessing rather than of cursing, of optimism rather than of pessimism. I have no wish to weary my readers, if such there should be, with a dissertation on valvular diseases of the heart and their physical signs; they probably know as much as I do about them, but I think it will be a help to give this short summary of their incidence and their gravity.

Firstly, valvular disease, excluding congenital malformations, is acquired, not in-

herited. Secondly, far the most common cause of chronic valvular disease is an infective process, producing endocarditis ; of these infective processes acute rheumatism is the most common, but the poisons of enteric fever, scarlatina, erysipelas and gout may produce the same effect. Syphilis is another cause, but probably does not act in quite the same way. The only other causes as far as we know of valvular disease are, prolonged and severe muscular strain and in later life atheroma. The diseased condition is primarily an inflammatory thickening of the valves, which produces a fibrous cicatricial tissue ; this fibrous tissue has a tendency, as life goes on, to contract. This contraction may never take place, but if it does the symptoms of stenosis or of incompetence become more marked and more serious.

Thirdly, diseases of the mitral valve form more than half of our cases, and regurgitation is more frequent than stenosis ; aortic regurgitation alone or combined with aortic stenosis forms about one-fifth of the number ; almost any combination may occur, but that of aortic regurgitation and mitral regurgitation is the most common. Diseases of the pulmonary valve are very rare and not of great moment.

Tricuspid regurgitation is frequent as a late result of mitral disease, but is rarely due to original inflammation; the closure of this valve is so feeble and often so imperfect that regurgitation is probably frequent without any physical symptoms; a strong evidence of the existence of tricuspid regurgitation is the occurrence of the ventricular form of jugular and liver pulsation without any detectable murmur. With regard to the gravity of the different valve affections, one must look on the aortic regurgitation as the most serious, and next to it mitral stenosis—mitral regurgitation and aortic stenosis not being of quite such importance as far as life is concerned; but even with the first two a breakdown can be for a long time postponed—if the heart muscle itself keeps up its tonicity and strength. The liability to sudden death, which is not common in pure valvular disease, is greater probably in aortic regurgitation than in any other form.

Aortic regurgitation showing itself first in middle age, and not as the result of rheumatic fever in youth, is always very serious; it is generally the outcome of overstrain combined with intemperance, of syphilis or cardiosclerosis, and is frequently found with com-

mencing kidney disease. Successful compensation can hardly be looked for in such cases, and unless the life can be most carefully ordered an early death must be expected. Anginal symptoms often appear, as the coronary arteries become involved in the sclerotic disease, *Mitral Stenosis*. Mackenzie says: "This is perhaps the most common of valvular defects with which heart failure is associated. It is generally the result of acute rheumatism or some other febrile disease. The condition is never recognised during the acute process which induces it, for this reason, that the murmur is not produced till the cicatrising process following the inflammation narrows the orifice; and, on account of its origin in scar formation, it is often a progressive lesion." This clear statement shows well the dangerous character of this defect. We practically never see it till it is an accomplished fact, and the early symptoms then are so slight that we seldom get the chance of giving the heart the complete rest it needs; in this way it stands in marked contrast to mitral regurgitation. Still even in this affection the disease may be non-progressive, and the patient may live to a good old age; but such cases must be considered rare. The usual

course is steadily progressive contraction of the valves, and interference with the work of the whole heart; and not infrequently, the chordæ tendineæ and the auriculo-ventricular bundle becoming involved, we get auricular fibrillation and other rhythmical defects added to the already embarrassed heart. With such a complication we need not wonder that the heart muscle soon fails to carry on its work.

The above résumé of valvular diseases is meant only to serve as a reminder of what we most of us already know, but which some of us may have in part forgotten. For the minute discrimination of physical signs, for a complete description of the complications that so often arise, and of alterations of rhythm, such as auricular fibrillation and auricular flutter, I must refer my reader to the more modern textbooks. It must be seen, then, that our principal aim and object must be to educate and strengthen the heart to stand up against its new difficulties, and if possible to overcome them. If we are fortunate enough to see the patient in the acute or sub-acute stage of the causative illness, the first thing to give is rest, and that as complete as possible.

In rheumatic fever, we should give salicylate of soda freely. I think it is not sufficiently realised that the beneficial action of salicylate is much more certain if we give bicarbonate of soda with it—the theory being, I believe, that the salicylate acts better if the blood be rendered alkaline: the proportion should be at least two of bicarbonate to one of salicylate, and perhaps two and a half to one would be a better proportion still.

The old alkaline treatment of rheumatic fever in the pre-salicylic days was chiefly carried out with potash salts; if we were to use these in the large doses required, we should run a grave risk of depressing the heart muscle, this effect of potash salts being well established. Some writers have doubted if salicylates have any direct action on endocarditis. It is a thing impossible to prove, but I think the logical assumption should be this—that a drug which can indubitably relieve and cut short inflammation of synovial membranes should have some similar action on inflamed endocardium, and further, that a drug which indubitably shortens the duration of the disease should by so much lessen the risk and extent of endocardial complication. Salicylate and

the bicarbonate of soda should be kept going for some time after fever has gone, but at steadily increasing intervals. In such cases, when signs of valvular implication have appeared, very prolonged rest is most advisable; three months in bed or on the sofa is none too long in most cases. This gives the heart muscle time to recover its strength, and also, which is most important, gives the inflammatory process in the endocardium time to subside. During the period of rest, even if there be irregular action of the heart and signs of dilatation, I think the extrinsic vegetable heart tonics should be entirely withheld: I allude chiefly to digitalis, strophanthus, convallaria, and spartein. If there be faintness and respiratory distress, strychnine may be given hypodermically in big doses. This rule about heart tonics applies, I think, quite as strongly in those conditions of heart feebleness which we find as the result of diphtheria, enteric, scarlet fever, and erysipelas. Rest and strychnine are here, too, most important. Is this cardiac weakness, and the muscle degeneration which causes it, the direct result of the infection? or is it due to something lacking in the internal secretions? My own belief is

that the failure of the suprarenal secretion is at least a contributory cause.

The following are extracts from Biedl's book on the internal secretory organs. "According to Langlois the amount of the active substance which raises blood-pressure is apparently unchanged in the hyperæmic supra-renal; while after chronic infective conditions, the capsule, though increased to three or four times its original volume, yields extracts which are totally inactive. According to Luksch the suprarenals of rabbits, poisoned with diphtheria toxins (tuberculosis typhus) do not contain a substance which either raises blood pressure or produces enlargement of the pupil."

Biedl himself says: "The enormous power which suprarenal extract has of producing vaso-contraction forms the rationale of its therapeutic employment in all those conditions where the circulation threatens failure in consequence of the sluggishness of the stream. Of these, the most comprehensive are: vascular paralysis, such as may be produced experimentally by destruction or inhibition, by means of toxins (chloral hydrate, chloroform), of the vaso-motor centres, and which is frequently seen in the last stages of some in-

fective diseases, and in many toxic states; and cardiac asthenia, in which, owing to inadequacy of the heart muscle and to the vascular paralysis, those symptoms of decreased circulation make their appearance which are known as 'shock' or 'collapse.' Paralysis of the vessels and cardiac weakness both produce a fall in arterial tension, and lead to a deficiency in the blood supply to the vital nervous centres, as well as to an insufficient filling of the chambers of the heart, to cardiac anæmia, and to ultimate arrest of the heart's action. By producing contraction of the engorged vessels in the splanchnic area, and so raising the blood-pressure, adrenalin effects a more favourable distribution of blood; it promotes the filling of the chambers of the heart, and increases the supply of blood to the nervous system." Later on he says: "In addition to its effect upon the vessels, adrenalin exercises a tonic effect upon the heart muscle, and for this reason its exhibition is indicated in all forms of circulatory inadequacy." Kothe's dictum "that adrenalin is the most powerful analeptic which we possess" is justified by clinical experience.

The experiments of these able observers and

their conclusions should lead us to use this remedy far more than we at present do. It is, to my mind, the safest and most powerful heart tonic that we have, and it has this in its favour, that it is a natural secretion of a mammalian body. My experience has been for the last few years that, in any case of heart failure, arising in the course of some microbic infective disease, and where the arterial tension is below the normal, supra-renal extract is a wonderful help. In pneumonia, for instance, I use it almost from the start, but I make the arterial tension my guide. For use by the mouth, which I think gives the best results, the extract of the whole gland should be given. There are good tablets, each containing five grains of the extract, on the market, and one of these may be given every four hours for many days (*i.e.* thirty grains daily). A rise of tension above 140$^{m.}$ will tell one when to stop. Liquor adrenalin given by the mouth seems to have very little lasting effect on the general circulation.

Oliver and Schäfer's original experiments, from which so much valuable knowledge has been derived, were made with a strong glycerine extract of the whole gland given by the mouth.

I believe that experience will prove this remedy to be of the utmost value in the stage of acute heart failure arising from infectious disease, and that it can be safely used when digitalis and strophanthus would do harm. Unfortunately we are more often called in to treat the results only of these acute and damaging diseases, and the problem then becomes more difficult and complicated. In addition to valvular defects we get probably dilatation or hypertrophy, or both, and we must be careful to distinguish and to measure the two conditions. The compensatory hypertrophy of the ventricles is often sufficient to keep a damaged heart going for a long time, with very few symptoms of distress. It is when this hypertrophy begins to fail and dilatation ensues that our help is claimed. This failure of power may have come on gradually and almost imperceptibly, or suddenly. In the former case the cause may be an unrecognised increase of bodily effort, or insufficient rest, or it may be weakening of the heart muscle by some intercurrent illness, as influenza. Again, it may be due to cicatricial contraction of the damaged valves or of the chordæ tendineæ. A careful investigation

and a correct decision will help one much towards giving relief. The first two causes should be removable by rest and a re-ordering of the patient's life; the third will probably require some medicinal help besides mere rest.

If there is, besides dilatation, shortness of breath and irregularity of the action of the heart, with or without a tendency to dropsy, digitalis should be given in doses large enough to produce physiological effects: ten or fifteen minims of the tincture three times a day, and more if necessary. If the liver be congested and the kidneys acting insufficiently (in such cases the urine is high-coloured, scanty, and of high specific gravity), the pill of mercury, squills, and digitalis may be given. One grain of the pulv. digitalis is the equivalent of about eight minims of the tincture: some physicians give calomel instead of the blue pill of this combination, and in cases where there is much constipation it is an improvement, I think probably $\frac{1}{3}$ grain three times a day would be enough. The following formula is generally good: Ft. pil. *t.d.s.* Pil. Hydrarg. g. 1; Pulv. Digitalis, g. $1\frac{1}{2}$; Pil. Scillæ Co., g. 2. Where there is high arterial tension this method of giving digitalis is especially good, as the

mercury by its action on the liver tends to keep down the tension, which the digitalis by itself might raise. This should produce shortly a stronger, slower, and more regular pulse, a freer action of the kidneys, and a lessening of dyspnœa; after a few days, unfortunately, with many patients nausea and sickness set in, and with it frequently a slow, irregular pulse. When these occur digitalis must be left off for a few days and then resumed in smaller doses.

Another plan is to alternate strophanthus and digitalis. To get the best result in such cases from strophanthus full doses are needed. There has seemed to me to be a considerable difference in the value of various preparations of this drug. I have got into the way of ordering either Duncan & Flockhart's special tincture or Burroughs & Wellcome's tabloids, for with these I always seem to get good results.

I dislike mentioning special drug manufacturers, but the above firms are so well known that nothing I say can benefit or harm them. In this connection I may mention Nativelle's granules of digitalin; the stronger one of gr. $\frac{1}{240}$ is very useful, and perhaps

causes nausea less than other preparations of digitalis. One tablet = ℿ 15 of tincture. After a short time of such treatment, we should be able to form a fair idea of the heart's capabilities towards recovery. The physical signs will help us to do this, but we must rely a good deal on the patient's own feelings. An intelligent patient, when being treated with these special heart tonics, knows very well whether he is better or not—in fact, many of them can be trusted to manage their dosage and continuance of digitalis or strophanthus for themselves. In certain cases of heart failure with dilatation, especially in old people, I have found a low arterial tension; in these, suprarenal extract in alternation with digitalin answers very well.

Of the other heart tonics, convallaria, spartein, etc., I have nothing to say; they seem to be of some use in functional disorders, but their sphere of action is not well defined.

The remaining helps to a tired, failing heart are, well-planned graduated exercises, and massage. These exercises should never be pushed to the point of exhaustion or of breathlessness. They comprise various exercises of the arms and legs with or without resistance,

and certain body movements. These are included in the Swedish and Nauheim systems. If very carefully done they help much to restore the tone of the heart muscle.

Dr. Mackenzie speaks very highly of sea-bathing. If this can be enjoyed in quiet water that is not too cold, it is certainly in some cases a great stimulant to the circulation (probably quite as good as Nauheim water), but many patients seem to get no reaction and to remain blue and cold. These cases can hardly benefit by sea-bathing. The exercise of swimming is one of the best, in fresh or salt water, for a weak, dilated heart. It must, of course, be done slowly, and the distances be gradually increased. A man out of condition improves his wind by this exercise wonderfully. There is one more exercise, which is perhaps the best of all, and that is sculling in a fairly light boat, so that no great effort is needed; sculling is better than rowing, for the reason that it exercises slowly and symmetrically almost every muscle in the body (care must be taken that the patient knows how to use his leg muscles against the stretcher, otherwise too much work falls to the arms and the heart may be overstrained). Most of these

exercises can only be undertaken by the milder cases of heart weakness. In the more severe cases, especially where signs of dropsy have appeared, steady upward massage of the legs will help considerably. Good general massage not only helps to get rid of the œdematous swelling, but improves the tone and the pace of the circulation all over the body.

By using these various remedies intelligently and with careful observation one may hope to see many a failing heart restored to comparative health and usefulness.

Dilatation of the Heart without Manifest Valve Disease

In middle life especially, but occasionally also in youth, we meet with cases of dilatation of the heart of varying degrees of severity, that come on without any apparent cause. (I am not alluding to those cases that are the result of some violent and prolonged effort.) The subjective symptoms are generally marked shortness of breath on any exertion, a quick sometimes irregular pulse, a feeling of great fullness in the chest, and areas of tenderness

and slight pain in the left side of the thorax and sometimes down the arms. The physical signs I need not describe. Roughly, a heart dilates for one of two reasons, or from both of them combined. First from some resistance to the onward easy flow of arterial blood; this resistance necessitates an increase of *vis a tergo*, of ventricular action, and this increase, if long maintained, may cause even a healthy heart to dilate, though probably after a preliminary period of hypertrophy. Apart from valvular obstruction, arterio-sclerosis, or its earlier stage of increased tension in the arterioles causing peripheral obstruction, is far the most common cause. Chronic Bright's disease comes almost under the same heading. The other cause is the state of the heart muscle itself; it is generally in the condition known as cloudy swelling or parenchymatous degeneration. This often follows the acute fevers, but is especially common after diphtheria and influenza. During the last twenty-five years in which influenza has been so much among us, these cases seem to have been far more frequent. In this state of heart muscle, a very little overstrain will produce dilatation, even where there is no peripheral obstruction,

either valvular or arterial. This is sometimes called "the influenza heart," the normal resistance being too great for the enfeebled heart muscle to cope with.

Far more commonly, at any rate in middle life, we get the two causes working simultaneously, and these cases require very careful and patient handling. Here the manometer is our great guide. Unless we can lower the tension and lessen the peripheral resistance, our efforts to strengthen the ventricular beat may do more harm than good. Here, I think, strophanthus is superior to digitalis as a heart tonic. It does not have any effect on the arterioles, as far as we know, and it can be continued, I think, for much longer periods; at the same time, by attention to the liver and bowels also, we can help to keep down the tension. The nitrites and nitro-glycerin may be given, but their effect is generally too transient to be of much help. Erythrol tetranitrate seems to be the best of them. An occasional dose of blue pill or calomel is of much good. Personally I rely almost entirely on the hippurates in these cases to lower the resistance. I shall refer to these more fully in another essay, and also to the contro-

versy as to the action of digitalis in high tension.

In these cases when the dilatation is extreme, we not infrequently get regurgitant murmurs, chiefly mitral; these will disappear as the case improves, but are rather confusing if one has not seen the patient before. The feeble first sound, the accentuated second sound, and the absence of the heaving systole against the chest wall, will distinguish the condition from that of hypertrophy. The wise and intelligent use of rest, of judicious exercise, of heart tonics combined with vaso-dilators, will generally give in the end very satisfactory results, unless the sclerosis has gone too far.

The dilatation and the hæmic murmur that one finds in anæmia and chlorosis need no special mention; the cure of the anæmia is the cure of the heart trouble. The functional heart troubles and their manifold causes are too large a subject for a practical essay of this kind. Angina pectoris remains a beautiful expression, but with as much and as little meaning in it as in "stomach-ache." It may mean the most serious and agonising form of heart disease, causing death very soon, or it may mean nothing but a mild neuralgia. The

varied and uncertain meanings given to the term are most unfortunate, for they often cause fear and anxiety where there need be none, and in consequence many lives are rendered miserable for years. If no strict meaning clinically or pathologically be attached to this term, the expression "pseudo-angina" becomes equally inaccurate and misleading.

Mackenzie says: "One thing that is necessary to insist on, is that angina pectoris is not a disease; but that it is merely a group of symptoms which afford no clue as to the real nature of the heart's complaint; so that inquiry must be made for other evidences which will elucidate this problem."

The organic lesions of the heart with which grave anginal symptoms are associated are chiefly aortic valvular disease, aortic aneurism, mitral stenosis, cardio-sclerosis, general atheroma and fatty degeneration of the heart muscle, but there are a few cases in which no organic disease can be detected by physical examination. The atheroma of the coronary arteries, which has been so frequently found after death, can, when existing as the sole cause, be only guessed at. All these conditions may exist and yet there may be no pain. So the

solution of the problem lies not entirely in the heart condition. The personal history of most cases shows, as a cause of the first attack, some extra strain, either sudden or continued. A man of forty-five or so tries to do something big in the way of effort, that he has not done for some years, or he makes some exceptionally continuous effort, such as running or quick walking, which he has been able to do in the past without discomfort. Exposure to severe cold is also reported as an occasional cause. The sense of pain may be sudden and severe, or the first few attacks may be mild and short; but the liability to, and the severity of this pain, steadily increase. The attacks of pain as time goes on may need little or no effort to bring them on.

There is another class of cases which I can only call fulminating angina, in which, without any previous warning, the most furious attacks of pain come on, causing the patient to grasp hold of something for support and to remain motionless, scarcely daring to breathe. The face gets very pale and the forehead breaks out into a cold sweat, and there is a feeling of great constriction over the whole front of the thorax. These cases, which are fortunately

rare, live as a rule but a short time—death comes suddenly by syncope in a very few weeks. These cases, I think, arise from acute degeneration of the myocardium, and generally have disease of the coronary arteries. They are not often seen as the end of valvular disease, and they occur in middle age, generally between forty-five and fifty-five, and the condition that causes them is not seldom hereditary. Not much can be done for them except to relieve the spasm by amyl nitrite inhalation, or if that fails by hypodermic injection of morphia and atrophine.

In the average case of angina, connected with one of the before-mentioned causes, much can be done to alleviate and to prevent. The ordering of the life so as to avoid hurry and strain must be the first thing. If the arterial tension be high, that should be slowly and carefully reduced. The hippurates may be very useful, and so is Lauder Brunton's plan of giving a good dose of 20 grains of nitrate of potash combined with two grains of sod. nitrite every morning before breakfast. The amyl nitrite or nitro-glycerine will be very helpful in the attack, or the following, which I have found very useful:

℞. Spt. Ether Sulph. Co. . . . ♏ 20
Liq. Trinitrin . . . . ♏ 1½
Tinct. Chloroform Co. (sine Morph.) ♏ 12
Spt. Ammon. Aromat. ad . . ℥ 1
℥1 in half a wineglass of water for a dose.

But the remedy that in most cases will do more good than any of the above is iodide of potassium in doses of 10 grains or more three times a day; if given with elixir of lacto-peptine and spirits of chloroform, it will generally digest well and not cause iodism. It is perhaps in the aortic and atheromatous cases that it answers best. I do not think it acts by any distinct lowering of arterial tension, though some physicians say that it has that effect. It should be continued for a long time, and will often give the most satisfactory results.

Indigestion which causes flatulence, distension of the stomach, and hyperacidity are both exciting causes of this pain. When once the disease is established, the diet should be carefully arranged to obviate these discomforts as far as possible. A comparatively dry diet, with no excess of starchy food, should be the central idea, fluid being taken between meals. An intelligent patient, if shown the reasons, will probably work out a diet for himself. Twice-cooked animal and fish food seems to be

a very common cause of flatulence with many. But the great question to solve is the cause of the pain. Under apparently identical conditions, one man gets angina and another does not. In some cases there is raised arterial tension and peripheral resistance, in some the tension may be below normal, but I think in the majority of cases the tension is raised. As far as one can judge the pain comes on because the heart is suddenly called on to make a muscular effort which, owing to obstruction or to some faulty condition of the muscle itself, it cannot accomplish. A painful condition of cramp or spasm is produced, beginning probably in the heart and spreading to the intercostal muscles and perhaps to the diaphragm. It is easy to understand how a severe cramp in the heart muscle becomes a great danger, while a cramp in a leg muscle is of no consequence, for the circulation must be temporarily arrested, and if the cramp does not pass off, death may ensue in the attack.

The seat of obstruction may be valvular, arterial, or in the coronary arteries of the heart itself, and in the latter case there seems to be greater danger, because the blood supply to the heart muscle is itself partially cut off.

Still the question of the cause of the pain is only partially solved. How far the nervous system enters into the problem is the doubt.

Mackenzie says: "Pain is usually referred to some portion of the distribution of the upper four left dorsal nerves in the chest and arm; sometimes the pain may be felt as low as the distribution of the sixth dorsal nerve in the epigastrium, and as high as the eighth or seventh cervical nerve in the ulnar border of the forearm and hand. It is rarely felt in similar areas on the right side. The pain is usually felt across the chest, and may remain stationary there; or it may radiate into the axilla and down the arm to the ulnar side of the forearm and hand. On the other hand the pain may start in the arm and radiate to the chest."

These clear statements point to some centres in the dorsal part of the spinal cord being concerned, not as organically diseased, but as in a state of irritability. Some of the nervous symptoms that are usual after an attack, such as the passage of a large quantity of colourless urine and the free expulsion of wind, point the same way. In fact, it seems that in a predisposed heart the trouble may arise at the

centre as well as the periphery. We must hope that further skilled investigation will throw more light on this problem and help us more to ward off attacks and to treat them more successfully than we do now. So far as our knowledge goes at present we can only advise our patients who suffer from cardiac pain that threatens to be angina, always to have with them capsules of amyl nitrite or tablets of nitro-glycerine. Sir William Whitla advises patients who suffer from frequent attacks of cardiac pain to break up one of the usual tablets of nitro-glycerine into six or eight parts, and to take one of the fragments every hour or so during the day. I have found this plan in my own practice very useful. Though one objects to the word "pseudo-angina," yet one must recognise that there is a class of person who gets cardiac pain that bears some resemblance to the true thing; but there are pretty marked signs of differentiation. Such patients are generally women, about the age of fifty, who get other symptoms of vaso-motor disturbance. The arterial tension is often high, but it varies much at different times. I think that nearly every woman, about or after the change of life, gets periods

of high tension, and that nature gives relief by the flushings and perspirations that are so common. The flushing has the same effect as amyl nitrite. In such cases there is no evidence of any organic disease, and there may be a history of excessive tea drinking or of tobacco smoking. The most important sign is, I think, the behaviour when the pain is on. The true angina sufferer remains as still and quiet as possible, almost afraid to breathe or speak; the false one fidgets about in a restless, excited way. Careful examination and observation will in most cases enable us to assure such patients that there is no danger, and attention to the arterial and nervous conditions should soon effect a cure. In the advanced stage of almost any form of heart disease, except, perhaps, in true angina, we shall meet with emergency cases that look like impending death. Such are cases of acute dilatation, of sudden pulmonary œdema, sometimes called suffocative œdema, and of advanced auricular fibrillation. Here we have to act at once, and, valuable as digitalis is in nearly all these troubles, yet there is no time for it to act when given by the mouth. (The hypodermic use of digitalin is generally futile.)

We have, however, a very rapid and safe remedy in the hypodermic injection of adrenalin; and the action is, I think, much helped if we give with it liq. trinitrin. The best way of giving this is the following: 8 minims of liq. adrenalin, 2 minims of liq. trinitrin, and fill up the syringe with water (boiled if you have time to get it) to 20 or 30 minims. The liq. adrenalin is too concentrated a preparation for most people. It not infrequently brings on pallor and a feeling of faintness for a few minutes. This is obviated by dilution. Many of these patients may have a high arterial tension, but this need not deter one, for adrenalin has none of its characteristic action on the coronary arteries, and the trinitrin helps its effect by lowering the tension in the systemic arterioles. Briefly put, the nitrites dilate the coronary veins as well as other systemic veins. The adrenalin dilates the coronary arteries and increases the contraction of muscular fibres, in heart, arteries and arterioles. Here we are relying entirely on the adrenalin's action on the heart muscle and on the coronary arteries. The hyperdermic use of strychnine may be used to follow the adrenalin, but it is of no use except in full doses—$\frac{1}{15}$ to

$\frac{1}{10}$ gr. By these means many an emergency can be tided over and the opportunity for the steady use of digitalis or strophanthus be established.

Another most distressing trouble that we often meet with in the advanced stages of heart failure is the inability to get any continuous sleep. One cannot call it insomnia, for the desire to sleep is very strong; the patient keeps dropping off and waking up again in a few minutes, often in great respiratory distress. Narcotics given by the mouth are of very little good, with the occasional exception of paraldehyd. The one great help in these cases is the hypodermic use of morphia and atropine or of morphia and scopalamine; one or other combination is better than morphia alone. If there be no great clogging of the lungs by œdema, or by bronchial catarrh, it may be used with confidence, both as regards success and safety. The hours of sound sleep that ensue rest, not only the patient, but the patient's worn-out, irritated heart. If there be inaction of the kidneys as a result, a hypodermic injection of pituitrin in the morning will probably put things right.

Though this essay has gone over much that

is old ground, and contains little that is new, I venture to hope that it may serve to concentrate some of the more modern knowledge of heart affections into more practical and useful methods of management and of therapeutics.

II

ARTERIO-SCLEROSIS

"Wherefore do ye spend money for that which is not bread, and your labour for that which satisfieth not?"

ISAIAH.

WHEN one carefully studies the diseased condition we call arterio-sclerosis or fibrosis, as Sir William Gull, its first describer, called it, its complications, its results, and some other disorders with which it is intimately associated, one must see that it enters very largely into the failures of health and into the premature deaths that occur so frequently between the ages of forty-five and sixty.

Dr. De Havilland Hall, who is an authority on this disease and also on its life-insurance aspects and its statistics, says: "that, though the average duration of life has considerably increased during the last fifty years, there has been an actual increase in the mortality rate among males between the ages of forty-five and sixty-five, and that between the ages of

fifty-five and sixty-five one-third of the total deaths are due to diseases of the heart and blood-vessels." These statistics are obtained from the Registrar-General's reports, and, as far as they go, must be accurate. My own feeling is that a good many more deaths could be brought under the same categories, for many deaths from paralysis and cerebral hæmorrhage are returned under those headings but are really the end results of arterio-sclerosis.

To the general practitioner it is a very important thing to keep his patients, who are approaching old age, in good health, and to prolong their lives as far as possible. It should not only be his interest to do this, but also his delight, for one's old patients are often one's best friends. Too many of us have got into the way of looking on this disease as incurable and unmanageable, but this is a great mistake. It is a complicated and intricate problem, no doubt, but that should attract the scientific mind to the elucidation of the problem and to the study of the causes and the treatment. I think we must all feel that the causes lie deep in our ways and habits, in the unnatural, high-pressure lives that so many of us seem compelled nowadays to live, and in the fact

that this increase of heart and vascular disease occurs in the male sex so much more than in the female. The competition of business and professional life falls almost entirely on our sex, but when we come into touch with the arduous, nerve-straining life that many society women live, the late hours and the over-stimulation of various sorts that it seems to involve, we see the same morbid results in their train. It is not the hard body worker, not the man who lives an outdoor, athlĕtic life, that develops sclerosis, as a rule, but the anxious, careworn brain worker, who works chiefly indoors and who often takes his work and his worries home with him and to bed with him. For such a man there can seldom be any real rest or freedom from the sense of strain. His sleep is rarely the sound, restoring unconsciousness that the body worker gets, and in very many cases the ability to meet this nerve strain is artificially kept up by stimulants of various sorts, but their effect can only act for a time. The physiological result of this life must be, in the first place, fatigue, exhaustion, and general impairment of vital energy, but in the second place hypertrophy and subsequent degeneration of the over-used parts of the body

(this is a law from which we cannot escape), and the over-used parts are chiefly the heart and blood-vessels. The athlete may call on his heart to do much abnormal work, but it is only for a short time, and the intervals of rest are long and sufficient for restoration ; but the man I am describing is the bow always bent. The activity of his brain is making demands on his heart and on his arteries night and day, and the vaso-motor nerves that govern the blood supply to the cerebral centres have no rest from toil.

Dr. George Oliver very wisely says : " Nervous, anxious temperaments, and occupations which involve much anxiety, worry and nerve strain, tend to produce somewhat higher levels of arterial pressure, especially in the latter half of life. On the other hand, placid temperaments and routine occupations—especially of the physical order—dispose to the lower degrees of pressure. I have observed that, as a rule, in subjects in good condition and training—such as athletes—the arterial pressure is certainly not raised, and is indeed very often somewhat below the average normal point, a fact which shows the importance of maintaining the functional activity of the peripheral

circulation by exercise. And this conclusion is supported by the observation that in those normal subjects who follow sedentary indoor occupations for many hours daily, the pressure, though generally normal, is more frequently above and less frequently below the mean normal pressure line."

There can be no doubt, I think, that there is a stage—probably lasting for two or three years—of almost constantly but moderately raised tension, before any real sclerosis takes place; and it is in this stage that we can do so much for our patients, to correct their habits of life and so to avert the grave symptoms that otherwise must ensue. Dr. Oliver says on this point: "In diffuse or generalised arterio-sclerosis, the accessible arteries may not be appreciably thickened, especially in the earlier stages of the disease, and yet the arterial pressure may be raised persistently and definitely. It would seem as if the disease begins more particularly in the terminal divisions of the arterial system—splanchnic and systemic, especially splanchnic. In this stage the peripheral resistance is apparently due mainly to muscular contraction in the arterioles; for these readily respond to vaso-dilator remedies,

and the increment of arterial pressure, which is not so high as it subsequently becomes, quickly subsides after each dose. In this hypertonic stage, the stage of pre-sclerosis of Houchard, the diastolic pressure rarely rises above 120 mm. and is often only 110 mm., and the systolic pressure does not, as a rule, exceed 160 mm. and is frequently only 145 mm. or 150 mm., and the arteriometer demonstrates the contraction of the radial calibre and the favourable effect of treatment in dilating it. But as the disease advances, organic changes in the arterial wall develop, when vaso-dilators only partially relieve the pressure, and when they may ultimately fail to lower it. In this stage the accessible arteries—such as the brachial—as a rule become thickened and the arterial pressure increases considerably; the systolic armlet readings advancing to such high figures as 200 mm. to 260 mm."

As practical physicians, then, our aim must be to get hold of our patients in this pre-sclerotic condition, to wisely anticipate and prevent the development of the serious organic changes that belong to the later stages. To do this we must be on the look-out, especially at about the ages of forty-five to fifty-five, for

any slight but persistent increase of arterial tension. There are various subjective symptoms that are often danger signals: viz., slightly increased shortness of breath on exertion, laboured action of the heart or slight palpitation; but perhaps of more significance are the head symptoms, such as vertigo, especially on stooping, occasional noises in the head, and an unaccustomed feeling of brain fatigue without any sufficient cause. At this stage there is, as a rule, no albuminuria, but the kidney condition should be carefully watched.

To form a clear and accurate idea as to the arterial condition and pathology and as to the relative importance of abnormalities, one must make a careful study of the literature of this subject, and this will not take very long. I would mention two small and inexpensive books, whose authorship is their own guarantee: "Studies in Blood-Pressure," by Dr. George Oliver (H. K. Lewis); and "Therapeutics of the Circulation," by Lauder Brunton (John Murray). From these clear and most reliable books the busy practitioner will soon get a good working idea of the subject. The estimation and significance of systolic and

diastolic blood-pressure and the use of the manometer and sphygmograph are all carefully explained. I need hardly say that the use of the manometer in arterio-sclerosis amounts to a *sine qua non.*

The hypertonic stage of muscular contraction, described above by Dr. Oliver, is probably the direct outcome of the over-strenuous life, and should be regarded as only a functional disturbance and therefore remediable. It is, of course, in this stage that we can really cure; in the later stages very much can be done to guide and alleviate, but not to cure.

To get fixed in our minds a clear idea of the physiology of the arterial system, I cannot do better than quote from Lauder Brunton, *Lancet,* vii. 24. 15: "The whole of the arterial system from the aorta down to the smallest arterioles has the power of contraction, but there is much more elasticity and less contractibility in the aorta than in the arterioles, where the contractibility is great and the elasticity comparatively slight. The whole system is richly supplied with nerves, some of which, the vaso-motor nerves, induce contraction, while others, the vaso-dilators, have an opposite effect. The arteries have

three functions. First, by means of their elasticity to store up the energy exerted by the left ventricle during its systole, and to expand this again in keeping up the even flow of blood during the diastole, when, in the healthy heart, the ventricle is completely shut off from the aorta by the sigmoid valves. The second function is to regulate the flow of blood to those parts which need it, by those vessels which supply the active organs dilating, while those of the other parts of the body contract. The third function, which is less generally recognised, is to pass the blood on from the arteries into the veins by peristaltic action, an action which causes the arteries to be empty after death."

Arterial tension may be briefly described thus: during the resting-time of the heart, between each beat, the circulation of the blood is maintained by the contractile power of the arteries, especially by that of the arterioles, which steadily urges the blood onwards into the capillaries; this power is known as arterial tension or pressure, and can be estimated fairly accurately by the sphygmomanometer. A large number of observations have shown what is the average pressure

at different ages, and we are thus able to talk of a normal or abnormal pressure or tension.

With this knowledge before us it must be evident that the perfection of physical life depends on the anatomical perfection and on the physiological well-being of the heart and the blood-vessels. The blood is not the life and the heart is not the life—the secret of this mystery lies far deeper—but both are life's indispensable ministers.

It would be a very good institution for all persons of middle life to have their hearts and arteries tested occasionally. A wise physician would be able to assure them that all was well, or he would be able to correct slight divergences from health, and to advise as to the mode of life and the amount of work that might be safely done.

If we find a man to be in the pre-sclerotic stage, what can we do? Firstly, much can be done by comparative rest, by early hours and long nights (the arterial pressure after a long night's rest is often 10 mm. below the average day pressure), by cutting down extremes of work or of social pleasures, and by the avoidance of excitement and over-stimulation. The

diet should be plain and simplified; red meat should be eaten in great moderation and not more than once a day. There is no need for an absolute purin-free diet, but it should be in that direction. Perhaps the chief thing is to avoid the flesh extracts, such as strong meat soups and rich gravies; for this reason boiled or stewed meats are better than fried or roast; this applies to fish and chicken also; a plain grill is good, but the frying-pan is a danger. Vegetable soups made with a bone stock may be taken. Cheese, eggs and milk should supply the greater part of the nitrogen food.

With regard to alcohol, one must say that the majority of such patients are better without it, but when a person has been accustomed to a moderate amount taken with his food it does not always do to suddenly stop it. The digestion may suffer and the general body tone be depressed. Alcohol is not a pressure elevator, rather the opposite. So many of these patients are inclined to have gouty tendencies that strong wines and malt liquors are certainly unsuitable. A little light wine, such as claret, still moselle or grave, may do no harm if taken with the meals only, and

the same rule applies to small quantities of old matured spirits. Alcohol, wisely chosen, and only used as a digestive tonic, may help, but when used as a frequent stimulant to enable the body or mind to do more work or to increase endurance for pleasurable excitement, it certainly does harm. Brunton says: "All the alcohols tend to dilate vessels, to lessen blood pressure and ultimately to diminish activity of the nervous tissues, although at first they may seem to have a stimulant action." In another place he says: "Alcohol produces dilatation of the peripheral vessels, and tends to lower the blood-pressure, while at the same time it stimulates the heart." Alcohol contains so little nutritive value (with the exception of the sugars and extractives of wines and beers) that in itself it may be said to give nothing to the body; it only enables a man to draw on his reserves. This may be useful in emergencies, or when used in great moderation, but unless so used, its inevitable tendency must be to exhaust the reservoirs of nervous energy. This question of alcohol must be handled by physicians on a thoroughly scientific basis. We shall do more for the cause of temperance by sober judgment

and advice, founded on scientific facts, than by hot-headed, unprovable generalisations.

Strong coffee, especially black coffee, taken after meals is certainly a stimulant, but is a raiser of tension; it has its good effects as well as its bad. Many folks are much the better for a good cup of *café au lait* in the morning. Tea probably does not raise tension to any extent, but taken in excess may easily produce tachycardia and irregularity of the heart's action, especially if the heart is working under difficulties. Good China tea seems to have less bad effects than the other growths, but it is not quite such a good stimulant.

The question of tobacco is very frequently presented to us, and it is not always an easy one to answer. Nicotine, no doubt, is one of the most powerful raisers of tension known, but in ordinary forms of smoking not very much gets into the system. Chewing tobacco and snuff-taking, which are nearly extinct, probably introduce more nicotine into the body than any form of smoking. With cigars the combustion is so complete that very little of the poison remains. There is rather more in pipe smoking. In cigarette smoking the

combustion is nearly as complete as in cigar smoking, but the cigarette smoker probably smokes much more tobacco in the course of the day than a cigar smoker, for he is never satisfied. The habit of inhaling the smoke of cigarettes is, however, the real danger; the absorption of nicotine from the bronchial mucous membrane is very rapid, and much more is absorbed in this way than by smoking through the mouth alone. The other chemical products of tobacco combustion, pyridine and the picoline bases, have probably their effects on the vaso-motor nerves also, but their evil influence is chiefly shown by irritation of the pharyngeal mucous membrane. Oliver in his experiments has found that in ordinary people, not excessive smokers, tobacco raises the systolic pressure from 10 to 15 mm., but does not raise the diastolic, so that the variation between the two becomes abnormal; this effect soon subsides after smoking is finished—in a quarter of an hour or so. We all know, of course, from experience that excessive smoking often produces tachycardia and other rhythmical disturbances, and even pretty severe cardiac pain; the ultimate effect of really excessive smoking is great feebleness

of heart and a very low tension. It will readily be seen that a drug which affects the circulation so strongly should, in cases where the arteries are diseased or in an abnormal state, be used with great caution and in great moderation. Tobacco, no doubt, has a quieting and soothing effect on many people with irritable nerves, and to this extent may be useful, but one cannot help coming to the conclusion that the average man who shows a tendency towards arterio-sclerosis had better give it up entirely; this applies especially to men who lead indoor lives. The man threatened with this disease has to face a very serious position, and should take no chances.

When we have removed, as far as possible, all deleterious external influences, we can do much to help our patients by medicinal treatment. The old routine of giving iodide of potassium in the pre-sclerotic stage, is, I think, a mistake; it often upsets the digestion and depresses without doing any real good. The vaso-dilators or depressors that we should rely on in this state are the nitrites, the hippurates, or the benzoates. The first are rapid depressors, but the effect is rather short-lived; but the two latter will generally do all we want,

and their action is more sustained. They cause no headache, and unless given in unnecessarily large doses produce no feeling of depression—indeed, most patients feel much the better for them. The head symptoms, the vertigo, the noises, and the sense of brain fatigue soon disappear. In this pre-sclerotic stage there is very often some dilatation of the heart, as one would naturally expect, and sometimes an irregularity of beat; this condition is soon improved by full doses of strophanthus or sulphate of spartein; in most cases these drugs are to be preferred to digitalis, and though not so powerful in their action on the heart muscle, are well able to cure the dilatation, if the tension be reduced simultaneously. In laboratory experiments strophanthin in poisonous doses increases arterial pressure, but I think that all clinical experience shows that in ordinary medicinal doses of the tincture of the seeds, this drug, while strengthening the heart-beat, has little or no action in contracting the arterioles. It will readily be seen how important a point this is.

Mackenzie, as the result of experiments on patients at the Mount Vernon Hospital, has

come to the conclusion that digitalis does not often raise arterial pressure, but that in some cases it even lowers it. These observations were, in his hands, made with the extreme care that we should expect from him, but I cannot help feeling that there is a partial error somewhere. His patients were at rest and otherwise placed in favourable conditions, but I think strongly that clinical observations of patients leading ordinary lives would give different results. It is a question that ought to be settled as far as possible, for digitalis is, without doubt, the most useful and powerful heart tonic of vegetable origin that we possess, and if there are dangers in its use we should have clear signals to warn us. Dr. F. W. Price confirms Mackenzie's views on its producing no rise of tension. On the other side Lauder Brunton says: "It is now generally recognised that digitalis has (1) the power of slowing the heart; (2) of making it stronger; (3) of contracting the vessels." In his résumé at the end of the chapter, he says: "Digitalis acts on the cardiac muscle, the intrinsic cardiac nerve, and the vagus centre in the medulla. It also affects the arterioles, causing them to contract; and probably it has upon them also

a twofold action, as on the heart, stimulating both the contractile muscular walls and the nerves which go with them."

Sir William Whitla, a very careful clinical observer, says: "Its action upon the arterioles must always be remembered, for by increasing peripheral resistance it raises the renal and general blood-pressure, and to this is attributed its striking value when dropsy has occurred." When the arterial tension is already high, as in valvular disease or Bright's disease, it may be necessary to administer a vaso-dilator in combination with it. Clifford Allbutt in his fifth volume of his *Dictionary of Medicine*, p. 961, says: "Tone we may define as that property in heart, artery, or other hollow viscus which preserves the mean diameter of the part; contraction as that which enables the organ, nevertheless, to obey stimulus and to perform particular acts. The vermicular movements of the bowel and of an arteriole are due to the quality of contractibility; their tone preserves their mean diameters in spite of distension or contraction. Were it not for tone a hollow organ, often subject to extravagant demands, would be strained, and perhaps ruptured. In the heart

it is tone which does much, if not all, to prevent loss of form under the great variations of internal pressure." Farther on he says, as the result of his experiments, "that digitalis produces a distinct increase of tone, which may be pushed to a degree inconsistent with normal function." Again he says: "Tone, then, is the quality to be watched and supported, and in digitalis we have a means of intensifying tone and of moderating distensibility. Now tone, like any other quality in excess, may be injurious, and the output of the constringed ventricle may fall short of the demands of the system. Again, when the muscle falls into degeneration digitalis seems to have other injurious actions, the nature of which is obscure." May we not extend this argument from the ventricular muscle to the arterial muscular coats? And will not observation of arterial pressure be the guide to the use of this powerful remedy? If we give enough digitalis to render perfect the tone of the ventricle and not to pass beyond that point, we shall probably be doing the same for the musculature of the arterioles, and thereby improve the general condition of the circulation and also the nutrition of the arterial coats

themselves. But if we press beyond this normal tone point, it is easily seen that we increase peripheral resistance, and so embarrass and add to the work of the heart. In arterio-sclerosis, I think, we often get signs of arterial degeneration before those of cardiac degeneration, and in such circumstances it may be that digitalis is especially harmful. The lesson, then, to learn is that when using digitalis as a heart tonic in arterio-sclerosis, we must carefully and frequently watch the tension, and we must stop the drug for a time if there be any marked increase, and especially if there be a marked diminution of urine.

The following is an attempt to formulate, for practical purposes, our present knowledge of the action of digitalis and of its sphere of usefulness. By its action on the vagus and the intrinsic nerves of the heart, it improves stimulus, it soothes and lessens excitability, and by so doing improves and regulates conductivity and rhythm. It decidedly increases contractility—so much so that a poisonous dose may cause the heart to stop in a state of systole; it increases also tonicity and so prevents the tendency to dilatation from internal pressure; but under excessive doses

this tonicity may be so augmented that the ventricle, not dilating sufficiently, is unable to receive and consequently to discharge the normal quantity of blood into the arteries. Its general effect, under wise dosage, is to improve the power and the nutrition of the heart muscle, and this result is not a mere passing thing. Its sphere of usefulness is chiefly in cases of commencing or partial failure of heart power and tone, and it may be given, with watchfulness, in any such case, whatever the valvular defects may be, though it will be better borne in some valvular diseases than in others. In disorders of cardiac rhythm, such as auricular fibrillation and flutter, it is especially indicated; in most cases of dropsy, resulting from circulatory failure, it is invaluable.

It should not be used in conditions of acute myocarditis, which so often occur in the infective fevers, and after this condition has passed away it should not be given if the heart muscle is producing good compensation by itself—first let the natural powers of recuperation have their chance. It should be given with great caution where there is much peripheral obstruction in the arterioles, as in advanced sclerosis and in Bright's disease

where there is high tension, but even in such cases it may be most useful if combined with vaso-dilators. In cases of extreme myo-cardiac degeneration, where there is no healthy muscle to respond, it will probably do harm, and cannot do good.

We have, then, in our hands a very powerful and useful weapon, but we must see that we do not draw it in a wrong cause.

To return to the treatment of the arteries in the pre-sclerotic stage: when the heart dilatation is cured by this combined treatment of tonics and vaso-dilators, it should not be difficult to keep the tension at the normal point, but these cases will, for some time, need careful watching and guiding; there is always a tendency for both the patient and his arteries to relapse. The hippurates should be given steadily for some months, but in diminishing doses. The salts in use are the sodium, the lithium and the ammonium hippurate—of which, I think, the lithium is rather the strongest. From five to ten grains daily are generally sufficient, but the dose may be pushed further if the patient is under observation. I have not so much experience of the benzoates, but here we should have to use

larger doses—thirty grains a day or more. The benzoates are not so well borne by the stomach as the hippurates. The nitrite group is represented by sodium nitrite, mannitol nitrate, erythrol tetranitrate, and liquor trinitrin, the dose of the three former being about one to two grains three times a day, and of the liquor trinitrin one or two minims three times a day. The effect of the mannitol and erythrol is probably more sustained. All these may cause headache, which the hippurates do not. Burroughs & Wellcome have, at Dr. Oliver's suggestion, made a most useful tabloid which they call "tabloid sodii nitrit. comp." This contains sodium nitrite, mannitol nitrate, erythrol tetranitrate, and ammonium hippurate. If something stronger than the hippurates is required, this rarely fails to reduce tension. When these simple remedies fail to materially reduce tension and to give relief to the subjective symptoms, we may feel almost sure that the disease has gone beyond the pre-sclerotic stage, and that we have to deal with actually thickened arteries. We may have to deal also with a hypertrophied heart and with commencing cardio-sclerosis; the problem thus becomes more complicated.

A most important point now is the state of the kidneys; if there is no albuminuria we may do much to alleviate symptoms and to prevent further progress of the disease. After careful ordering of the patient's life, we should steadily try to reduce the tension and to strengthen the heart's action, as in the early stage, but it will need much care. Where there is confirmed sclerosis, the point of normal tension, as concerns each individual, is no longer constant. One must try to find that point in each case, by watching and by the patient's own sense of well-being. In some cases you can get tension down to 140 mm. and they feel much the better for it; others would get irregular heart action and be miserable. The extreme degrees of tension such as 200 mm. and over should certainly, I think, be attacked, but there are very many cases who do well and lead fairly comfortable lives, by the tension point being reduced to 160 or 170 mm. These patients, if the kidneys are fairly sound and if they lead careful, abstemious lives, may live to real old age, but they should be often under supervision; till they are well on to eighty they will often need medicinal help; after eighty generally

the tendency to progressive sclerosis ceases, the arteries become softer, and the general circulatory stress becomes less. The same drugs will help much in all these cases. An uncertain proportion of sclerotic cases will develop atheroma of the arteries; the seriousness of this varies much with the site of the affection. One often detects marked atheroma in the radial, brachial or temporal arteries without any special symptoms being produced. The danger point is in the aorta and cerebral arteries; cerebral hæmorrhage is of course the danger here. In atheromatous conditions the tension varies much, at any rate as measured by our present instruments; it is sometimes normal or below normal. When it is high it should be reduced with extreme caution. In many such cases nature has established a working equilibrium or compromise that is better left alone; all we can do is to help the heart and blood-vessels to carry on with the smallest amount of strain. Attention to the action of the liver and bowels will be very important and regulation of bodily work. In the cases of sclerosis at any stage, where there are clear signs of kidney disease, the outlook is, of course, not so good, but still

much can be done to help. The reduction of tension in the general arterial system will affect the kidney vessels also, and lessen congestion; it will probably help also towards better elimination. The action of over-dosage of digitalis in causing contraction of the kidney arteries, and so in producing suppression of the urinary excretions, shows how important the question of vaso-dilation becomes to a diseased kidney. The old woman's remedy, broom tea, represented now by sulphate of spartein, was undoubtedly a good diuretic, but better in cardiac dropsy than in that of Bright's disease probably. This effect was produced apparently by the drug's action on the heart muscle, without its producing any contraction of the muscular coats of the arteries. It would be outside the scope of this essay to deal at greater length with the kidney side of the question.

A very important point in the management of sclerosis is attention to the state of the liver. This organ, partly from the inactive life that in most cases has to be led, and partly from the diseased condition of its vessels, is liable to become congested and inactive in its secretions of bile; an occasional dose of blue

pill or calomel will give much relief, and so also will skilful abdominal massage. Without doubt mercury lowers arterial tension for a time. Sir Andrew Clark's observation that in most cases calomel was the treatment for hæmoptysis goes to prove this. A good way of giving mercury in such cases is to give one-tenth of a grain of calomel every two or three hours, till about three-quarters of a grain has been taken, and to give a good dose of sulphate of soda the following morning. The beneficial effect of calomel is, no doubt, partly due to its bactericidal action on the intestinal contents and to the consequent prevention of absorption of ptomaines.

In some sclerotic cases, especially where there is a tendency to obesity, thyroid feeding may be of great use, and will in the future, perhaps to a great extent, supersede other medicinal treatment. Though laboratory experiments show some divergence of results, I think we must regard it as an established fact that thyroid extract is a tension depressor. The original experiments by Oliver and Schäfer seem conclusive, and Biedl in his work on the internal secretory organs corroborates

these conclusions. Brunton says: "Thyroid gland, when taken by the mouth, dilates the peripheral vessels, makes the skin warm and moist, and quickens the pulse. In this respect it antagonises the suprarenal secretion. Besides this effect on the blood pressure it has other effects on metabolism which are important." Biedl says: "If thyroid extract or iodothyrin are given continuously for two or three weeks, the amount of CO_2 excretion will be increased by 15 to 25 per cent. The nitrogenous interchanges are invariably disturbed by thyroid extract; the increased decomposition of albumen is expressed by an increased excretion of nitrogen. By increasing the caloric food supply, the nitrogen losses may be avoided. In obesity, owing to the large reserve of fat, the loss of albumen is not as great as in the normal subject. Thyroidism also brings about a considerable increase in the amount of calcium excreted in the fæces, the calcium carrying off with it a large proportion of phosphorus. Scholz had before shown that thyroid extract produces in man an increased excretion of phosphorus." It is very evident that we have in thyroid medication something much more than a mere tension depressor.

Its other properties, influencing the excretions, explain to some extent its sphere of usefulness and its drawbacks. The increased excretion of calcium may be very beneficial in sclerosis, especially perhaps when there is atheroma; the loss of phosphorus accounts in some measure for the debility and for the nervous symptoms that often follow its use. The increased output of CO_2 and N. is probably all helpful, but all these bye effects should be produced slowly and cautiously. I have thought that thyroid treatment in sclerosis is more satisfactory in cases where there is no kidney complication; this is not unlikely, as in Bright's disease the kidneys would only imperfectly carry off the results of increased nitrogen metabolism, and this failure of excretion would leave the blood overcharged with these products. An Eastern proverb says, "Don't stir up sleeping dogs if you can't kick them off the premises," the moral of which is not difficult to see. The loss of phosphorus can be well remedied by giving lecithin. We should bear in mind that thyroid extract and parathyroid extract are in some measure antagonistic; thyroid contains, in Schäfer's language, an autacoid or stimulator

of nervous energy and of some other excretory glands, as the suprarenal; parathyroid extract contains a chalone and has the reverse effect. I cannot help thinking that some of our theraupetic experiments are brought to naught by preparations carelessly made and containing the extracts of both glands. In thyroid treatment we must stop short, if we can, of producing its disagreeable effects, palpitation of the heart and giddiness; the sphygmo-manometer is generally a good guide, but if these symptoms come on, they are generally relieved most effectually by suprarenal extract, a 5-grain tablet once or twice daily: this sounds like an illogical proceeding, where you are trying to lower pressure, but in practice it succeeds well. It is well known that thyroid exhibition in health increases the amount of adrenine in the blood; this is probably a wise compensation, and one can readily understand how in disease this compensation may fail to take place. Though in obesity thyroid often causes loss of weight, in thin people who are suffering from hypo-thyroidism it often has the opposite effect. In thyroid treatment, especially as old age draws near, and quite apart from myxœdema, we have

before us a most interesting field of study, full of possibilities and of hope.

For many years iodide of potassium has had a great reputation in the treatment of arterio-sclerosis, and it apparently does do good in certain cases; but, as far as experiments show, it has no direct effect in lowering blood-pressure; it is quite likely that it acts, as all preparations of iodine do, by stimulating and increasing the output of the thyroid secretion. It is a disagreeable drug to take, depressing, and not always easily digested; and thyroid itself should, in my opinion, be tried first. Sajodin is an iodine preparation that is better borne than potassium iodide. Rendle Short says: "An increased thyroid secretion may be obtained by giving iodides. Here we find the explanation, so long sought in vain, of the effects of iodides on gummata, arterio-sclerosis and aneurism. The beneficial agent is really the increased internal secretion of the thyroid gland. Two important results of observation and experiment confirm this theory,

In the first place, in cases of myxœdema, arterio-sclerosis is early and intense. The same is true in animals after removal of the thyroid. Eiselsberg gives a number of very

convincing photographs of intense atheroma of the aorta in his cretin lambs from which the thyroid had been removed. In the second place, thyroid extract has a wonderful power over young connective tissue, as is seen by the way in which it absorbs the subcutaneous thickening of myxœdema and cretinism. It is not surprising, therefore, that it should be able to deal also with gummata and atheroma."

With these facts before us, is it unreasonable to think that the subthyroidism which is so common as old age approaches is one, if not the chief, cause of atheroma? And is it not reasonable to expect that in such cases thyroid feeding will prevent the extension of the disease and will very possibly cause absorption of the morbid deposits already present?

In the general management of sclerotic patients, plenty of fresh air is necessary, and steady, moderate exercise; their inclination is to lead a sedentary, indoor life, but this is distinctly bad for them. Physical exercise must be of a nature that puts no great strain on the heart and lungs, and to ensure this hurry must be avoided: not hurry alone, but even the feeling of being hurried or rushed,

raises the arterial pressure, before any movement has begun. Horace's advice, "æquam memento rebus in arduis servare mentem," applies with double force to such folk.

The best exercise is probably walking, on the flat at first, and subsequently, as improvement takes place, up graduated inclines. Cycling or, better still, tricycling when roads and winds are not unfavourable, is good, and not so monotonous. Horseback exercise, on a horse that is not a puller, is perhaps the best of all. Sculling, again, in a light river boat is very good work, and, if not hurried, puts very little strain on the heart, and quietly exercises most of the body muscles. Well-regulated exercise spreads the circulation of the blood over a much larger area; in rest the blood, to a great extent, collects in our internal reservoirs, but exercise sends it coursing through all the arterioles and capillaries of the muscles of our limbs; thus internal congestion and pressure is relieved. Probably with a sedentary indoor life the viscosity of the blood is increased—this is a problem that needs working out. It must be evident that an increase of viscosity of any circulating fluid must demand increased force from the central driving power.

Oxygen, without doubt, lessens the viscosity of the blood, and so reduces the heart's work.

Sir Lauder Brunton, at a meeting of the Medical Society of London a year ago, related a very instructive case. A patient with advanced kidney disease was at death's door, and it was thought necessary to bleed her, but the blood could not be got to flow from the vein on account of its viscosity; a cylinder of oxygen was in the room, and the happy thought came to him to use it as an inhalant: in a few minutes the blood began to flow, and in a few minutes more there was a full stream. This all emphasises the need and advantage of open air.

Here I must draw attention to the great value of bleeding in cases of extreme high tension, and especially when there are symptoms of threatening apoplexy. Bleeding from the arm is the quickest method, but if there are objections to this, a leech or two over each temple and two or more at the back of the neck will answer well; the leech bites should, of course, be kept running by warm fomentations for some time. The good that results is no doubt due not to the mere emptying of

the blood-vessels, but to the alteration of the quality of the blood; as soon as the vessels are partially emptied of the blood, they fill up again, by extracting the watery constituents of the tissues, and thus the viscosity of the blood is reduced. In this state of blood arsenic seems to be beneficial. There remains the important question of balneology and electricity in the treatment of this disease. The Nauheim treatment, as carried out at Nauheim especially, acts perhaps as much in reducing arterial tension and peripheral resistance as in causing contraction of the dilated heart; the immediate effect of the bath is to produce great dilatation of the surface arterioles and capillaries of the skin, in fact, cutaneous hyperæmia of an active kind; this naturally lessens the amount of blood in the important splanchnic area, and so relieves the work of the heart. This treatment can be well imitated at home. In the *Practitioner* of August 1912 is a clear and instructive article by Dr. Thorne on the good effect of the Nauheim treatment on arterio-sclerosis as carried out in England. Other waters have a somewhat similar action—for instance, Gastein and Llangammarch Wells in Wales; it is probable that the radio-active

character of some of these waters adds to their usefulness.

Electrical treatment, where obtainable, may be a great help. In the early stages, I think, high frequency is of some considerable help in reducing blood-pressure, and its action is more than a passing one; it also acts as a general tonic to the vaso-motor nerves and increases metabolism probably; in the later or confirmed stages of sclerosis it is not of much use, I think, but here the Bergonié-faradic method seems to have a marked effect and a lasting one. It is perhaps hardly necessary to say that these treatments must be carried out by physicians who have made a special study of electricity and who know its limitations and its risks.

When all has been said about the treatment of this morbid condition we call arterio-sclerosis, we are sure to be faced with a somewhat sceptical criticism; one will ask, "Is not this thickening of the arterial coats and its increase of tension Nature's method of keeping up a failing circulation?" One must honestly answer, "Yes, to a certain extent": the same criticism would apply equally to the case of hypertrophy of the ventricle, which grows

stronger and bigger only to meet an increased demand. The sclerosis is a fault to compensate in a measure for another fault; but if one can remove or partially cure the originating and causative fault one may and should surely treat and cure, if possible, the resulting fault; it cannot be our duty to stand by and see the vicious circle of disease go on to its end unbroken. The original causes of the disease, except in those sad cases where the tendency is strongly inherited, are largely removable, for mostly they arise from physiological law breaking and from mental overstrain. Let us then throw aside this weight of paralysing hypercriticism, a sin that doth so easily beset us, and march boldly but cautiously on in the path of restoration and of healing.

After all our theories and speculations, the high court that has to pronounce judgment is formed by our patients themselves. Ask any man or woman who has suffered from the miseries and discomforts of arterio-sclerosis, when accompanied by high blood-pressure, how they feel, after that pressure has been carefully and judiciously reduced, and you will get no uncertain answer. They can work and think far better; their breathing is much

easier, and they lose the cardiac and the cerebral discomforts that made their lives so miserable. Their sleep becomes again quiet and refreshing; and beyond the improvement in these subjective symptoms, there is a condition of far better general health and, what is perhaps more important, of greater safety. It must be evident that any one attempting to lead a strenuous, active life, either in mental or bodily work, with a tension much above the normal, is in daily danger of a bad break-down, of one that will practically end his working days. It should be, therefore, our manifest duty to bring all such to the knowledge of their danger, to persuade them to lead a new life, and to grasp the means of safety that we can offer them.

During the last few years, it has been the fortunate lot of many of us to be able, with our sclerotic patients, to steer them safely through the dangerous years and shoals of later middle age into the quiet and restful harbour of real old age, free from paralysis and with mind unclouded.

III

THERAPEUTIC SPECULATIONS AND DOUBTS

The truest courage lies,
Not in unseeing eyes,
Owning no danger, blindly rushing on;
But in the eye that sees
To grasp the golden keys
Of power and circumstance, and make them one.

When we, in all honesty and out of our patients' hearing, take stock of our therapeutic experiences, we must, I think, allow that our expectations have oftentimes been unfulfilled, or that the results, at any rate, have not been commensurate with our hopes. That this should be so is no cause for wonder and certainly no cause for despair. Till quite recently we were most of us brought up in a school of almost pure empiricism, of traditions, and often of illogical conclusions. It is only in the last twenty or thirty years that either the plant remedies or the chemical ones have been studied at all accurately from the physiological

point of view, and the results tested by scientific methods and instruments. Many of us can remember the wave of pure scepticism that passed over the medical world in the times of Gull, who had the courage to treat seventy cases of acute rheumatism with the old alkaline potash treatment, another seventy cases with peppermint water, and to publish his results. This scepticism and honest criticism undoubtedly did good—it cleared our minds of a certain amount of cant and of ignorant prejudice—but in itself it led nowhere.

If in therapeutics we lose faith and hope, we become in a measure paralysed, and, what is perhaps worse, we develop an underlying feeling that we are sailing under false colours and are not giving a *quid pro quo*, or as Goodhart puts it, a *quo pro quid*. To-day surely there is no room for faithlessness nor for hopelessness ; our knowledge is infinitely wider and surer ; it still is very necessary to keep the judicious and critical mind, but our power over disease is daily increasing. The effects of the plant remedies are still often a matter of doubt, though the standardisation of tinctures and the extraction of alkaloids have put things on much surer ground ; these remedies, though

very often useful—some of them, indeed, being seemingly indispensable—will eventually, I think, lose much of their prominent position, for the reason that they are foreign to the animal system. The inorganic remedies come under rather a different heading; many of them, like iron, arsenic, iodine, potash and soda, are already constituents of the flesh and blood, and in a measure they can be regarded as body foods; but the great future, I venture to think, belongs to the organic animal remedies, to the ductless gland extracts, and to organic chemistry.

In this essay I am attempting to give a résumé of our present-day knowledge of ductless gland therapeutics and to make, as a result of personal experience, a few practical suggestions. We general practitioners have very rarely opportunities for making or seeing laboratory experiments for ourselves; we, therefore, have to go to the best authorities available and to accept their conclusions, at any rate for the time: other men have laboured, and it is our privilege to enter into their labours and to translate their results into practical service.

So that we may get a clear understanding

of the nomenclature of this subject, I propose to adopt the terms and definitions that Sir Edward Schäfer has used in his lectures.

1. Material which passes into the blood or lymph from any tissue or cell of the body is termed its internal secretion.

2. Organs which, so far as is known, possess no other function than this, are called internally secreting or endocrine organs (*ἔνδον*, within, and *κρίνω*, to separate).

3. This term, as at present understood, comprises the thyroid, the parathyroid, the suprarenal, the pituitary and the pineal glands. (Other glands, like the pancreas, the ovary and the testis, have properties to some extent similar to these glands, but they do not come so definitely under the head of internally secreting organs, as they have in a sense both internal and external secretions.)

Schäfer's definition, then, is "an organ which is known to form some specific chemical substance within its cells and which passes this directly or indirectly into the blood stream. The substance thus formed is the active material of its secretion, just as ptyalin is the active agent of the salivary secretion; but while the salivary secretion is conveyed by a

duct to the exterior, in the case of the ductless glands the secretion remains within the body and circulates with the blood."

The active agents of the external secretory organs differ from those of the internal secretory organs, in that they belong to the class called enzymes, and that they are of the nature of a ferment and are destroyed by heat. The active agents of the internal secretory organs are not so complex, and are not destroyed by boiling; they are dialysable, and some of them can be isolated in a crystalline form; the active principle of the adrenals has even been made synthetically. They act quickly on the cells which they influence, and when injected into the blood stream have an immediate effect, whereas an enzyme acts more gradually. The action of these principles is not unlike those produced by the active principles of drugs, especially by those of vegetable origin. They also operate by immediate chemical action, being conveyed to their special parts by the circulating blood. Like drugs, some of the principles contained in these extracts act by exciting or stimulating cell functions, others by depressing such functions; the former are called "hormones"

(ὁρμάω, to stir up), and the latter "chalones" (χαλάω, to make slack). The expression "hormone" has now got such a widely extended meaning that Schäfer has coined a new expressive word, "autacoid" (αὐτὸς, self, ἄκος, a remedy), which he defines thus: "An autacoid is a specific organic substance formed by the cells of one organ and passed from them into the circulating fluid to produce effects upon other organs similar to those produced by drugs. Such effects are either in the direction of excitation, in which case the endocrine substances producing them may be termed excitatory autacoids and so would come under the expression 'hormones,' or in the direction of restraint or inhibition, in which case they may be termed restraining or inhibiting autacoids and be classed as 'chalones.' The action of an autacoid may be termed hormonic or chalonic according to the kind of effect it produces."

Some autacoids appear to produce opposite results in different parts of the body: thus adrenine causes contraction of the plain muscles of the blood-vessels and inhibition of that of the intestines. In both cases the action may be regarded as that of a hormone, for both effects

are produced by stimulation of the end substance of the sympathetic nerves. The possibility of the same autacoid acting under some circumstances as a hormone or excitant and under others as a chalone or depressant must be borne in mind. This illustrates the drug-like nature of these principles, for such inversion of action under different circumstances is known to occur with some alkaloids."

For a more scientific and complete description of this most interesting subject I would refer my readers to *An Introduction to the Study of the Endocrine Glands and Internal Secretions*, by Sir Edward Schäfer, published by Stanford University, California, 1914. 75 c.

What a field for study, for observation and for successful practice these discoveries open up for us, one must at once perceive. We begin to get a glimpse of the innermost secrets of life—of those marvellous agencies which maintain the physiological equilibrium of our bodies, and which under ever-varying circumstances enable us to fight this good fight of vitality versus decay. The knowledge we have already obtained has produced most important results, but we are not yet within sight of the horizon of the therapeutic possibilities.

These ductless glands, by their secretions, control and activate not only each other but the great sympathetic nervous system and all the vital processes of the body. The secretions of most of these glands, from some points of view, appear to be antagonistic to one another, but from other points of view helpful and compensatory. In their totality they are the essence of life itself. Our aim and hope must be, by patient study and by experiment, to bring these powerful and apparently divergent remedies into such use and combination that they will make harmony again out of the discord we call disease.

It would be difficult to say which of these glands is the most important, but the thyroid, I think, must come first, as its errors apparently are concerned more than those of others with the ordinary morbid conditions of life. Without going into the anatomy, the histology, or the development of the thyroid apparatus, we must bear in mind that it consists in man of two lobes united by an isthmus, and of four parathyroids. It is found in all the vertebrates. It is a very vascular organ and contains many lymphatics. The nerve supply is from the sympathetic and from the vagus,

and is distributed both to the blood-vessels and to the secreting epithelium. Its vesicles contain the "colloid" which almost for certain contains the active principle of the gland; this colloid is insoluble in ether, alcohol, or water, and contains iodine. The parathyroids are, in man, closely attached to the thyroid, but are physiologically distinct; vesicles containing colloid material similar to that of the thyroid are often found in them, but the similarity of the chemical nature of the two colloids is not proved. If the thyroid be completely removed and one or more parathyroids be left, the colloid-containing vesicles of the remaining ones increase in number and size.

The normal functions of the thyroid apparatus can be best arrived at in the first place by noting the effects of removal.

If the parathyroids be completely removed, most animals die within a few days or weeks; the carnivora are the more rapidly affected. The symptoms belong chiefly to the nervous system, and show generally exaggeration of reflexes, passing on into clonic muscular contractions and then into convulsions; the symptoms closely resemble those of the disease

called " tetany." This disease has frequently occurred in man, after a complete removal of the whole thyroid and parathyroid apparatus, and can only be cured by a successful graft of a human parathyroid. In operations for removal of thyroid tumours it is necessary, in order to prevent these dangerous symptoms, to leave two of the four parathyroids. The most satisfactory explanation of " tetany " coming after parathyroid removal is the assumption that they give to the blood an autacoid which has an inhibiting or chalonic effect on over-excitation of nerve cells. The removal of parathyroids in growing animals probably causes delay in the growth and development of bones and teeth. The effects of removal of parathyroids has been relieved by the injection of extract of parathyroid; pituitary extract is reported to have a like effect. Schäfer concludes by saying that no other substance appears to exhibit the specific action on the nervous system of this parathyroid autacoid.

Ott says that intravenous injections of parathyroid extract have quite a different effect from those of thyroid. The blood-pressure is first raised, then depressed; there is an in-

creased respiratory rate; they are diuretic, acting directly on the renal epithelium; and in large doses they lower the body temperature. Applied locally they increase contraction of intestine and uterus and dilate the pupil.

If the thyroid be removed or become atrophied (two or more parathyroids remaining), the following are the chief symptoms, these being more marked in the young than in the mature: arrest of growth, especially of the skeleton, and delay in the development of the generative organs; the skin is swollen and dry, the hair thin, the face pale and puffy, the abdomen swollen, the nose depressed, the hands and feet podgy. The fontanelles remain open, the muscles are weak, and the higher functions of the nervous system remain undeveloped, this being due to arrested development of the cortex cerebri. In short, we have the condition called "cretinism." This condition may be sporadic or endemic, the former being caused by early atrophy or by absence of the thyroid, the latter by goitrous degeneration. McGarrison says that in India there are two types, the myxœdematous and the nervous, the latter presumably being associated with parathyroid deficiency. The first type

is the more common in Europe. These symptoms rarely are seen till some little time after birth, the theory being that the thyroid insufficiency is compensated for a time by the autacoids conveyed from the mother, before birth by the placenta and afterwards by the milk. If thyroid atrophy comes on in adult age, the condition called myxœdema comes on. This also frequently supervenes on complete surgical removal of the gland. Kocher says: "If about a quarter of the gland is left, the symptoms of thyroid insufficiency do not appear." This is Schäfer's description: "It is characterised by the thickening and swelling of the skin, which pits on pressure, the pitting disappearing on relaxing the pressure; by the skin becoming dry and the hairs falling out; by a low body temperature, by mental dullness, and by general impairment of sensibility." Metabolism is lessened, so that body weight may increase in spite of a smaller intake of food; there is often a considerable deposition of fat, especially under the skin, and there is a diminished amount of oxygen consumed and of nitrogen excreted. There is a diminished excretion of calcium salts—after parathyroid removal only, an increase of this

excretion has been observed—and there is an increased tolerance for sugar; in thyroidectomised animals a full injection of adrenalin, which in ordinary circumstances would produce glycosuria, fails to do so; in this respect also the thyroids and parathyroids seem to have opposite action. The skin of the face is often affected more than in other parts, especially under the eyes, and gives the peculiar expressionless, masklike appearance which we associate with myxœdema. The general conclusions arrived at by Biedl, Eppinger and others, seems to be this: "that the thyroid and the chromaffine system, together with the infundibular portion of the hypophysis, constitute a group of vascular glands which augment and accelerate the processes of metabolism. The balance is maintained by the antagonistic activity of those other vascular glands like the pancreas and the parathyroids which exercise a restraining influence upon metabolism. These two groups of internal secretory glands possess physiological interrelationships with one another; the extirpation of a vascular gland is followed by differing sets of phenomena. Firstly, there are the direct results, due to suppression of the specific

secretion; secondly, there are the indirect results, due to derangement of other glands, the functions of which, under normal conditions, were either stimulated or inhibited by the secretion of the suppressed gland. The thyroid is believed to promote the activity of the chromaffine system and to inhibit that of the pancreas. The direct results of removal of the thyroid consist in reduction of the metabolism of albumin, fat, and salts; the indirect results are on the one hand the absence of stimulation of the chromaffine system, and on the other a hyper-activity of the pancreas due to the removal of the inhibitory agent. It is believed that the nervous system is the agent by which the inter-activities of these vascular glands is affected. That group of them which promotes metabolism has a sympathetic innervation and stimulates the sympathetic nerves, at the same time exercising an inhibitory effect upon the autonomous nerves. The group which retards metabolism, on the other hand, possesses an autonomous innervation, and while stimulating the autonomous nerves, inhibits the sympathetic. The thyroid possesses a double function, being furnished with both classes of nerves, and is

thus able to affect both divisions of the vegetative nervous system." It will thus be seen what an important and central position the thyroid holds in our economy, and what numerous hints for treatment of morbid conditions and for the explanation of them the study of the subject suggests. The great abdominal sympathetic ganglion has been called the Clapham Junction of the system. In like manner the thyroid seems to be the principal centre of the system, that receives and transmits the hormonic and chalonic messages which pass from gland to gland, and which to such a large extent govern the processes of growth and nutrition in our bodies.

For practical reasons I think it will be better to consider thyroid insufficiency or hypothyroidism first. The external objective symptoms of myxœdema are so marked that one would think the correct diagnosis would rarely be missed, but in my experience this disease is often passed over or mistaken for Bright's disease; if there be any doubt as to the nature of the œdema, the examination of the urine will clear it up. It is not my intention to discuss the symptoms and treatment of complete myxœdema, for they are so well known, but I

wish to draw attention to the very numerous cases of hypothyroidism in which the objective symptoms are not clearly marked. These cases occur chiefly in late middle life and in old age. Hertoghe calls the condition "Hypothyroidie benigne chronique." There can be no doubt, I think, that this arises from partial degeneration of the thyroid and from a lessening of its colloid output. The symptoms are chiefly as follows, and show, I think, isolated symptoms of full myxœdema. These may last for years, and may never pass on, even if untreated, into the complete disease. Slight and sometimes transitory infiltration of the skin in certain parts of the body and in the lower eyelids especially; a common instance of this infiltration, often unobserved, is in the lower part of the leg just above the ankles, and not affecting the foot. This, if it does not remain pitted on pressure and if it be not caused by varicose veins, is almost a conclusive symptom. The hair becomes thin and brittle and loses its gloss and colour; the skin is generally dry and harsh and the scalp shiny; the temperature is sub-normal; the hands and feet are generally cold; there is a troublesome sense of chilliness over the loins and upper

part of the thighs, which causes these persons to be very sensitive to draughts of air, and they often get catarrhs. Muscular pains about the body, especially, are common and not easily cured by the ordinary rheumatic remedies. The general result is low vitality, mental and physical, a sense of chronic fatigue, and a feeling of inability to face the work of life. In most cases the arterial tension is above normal, and there are often present the cerebral symptoms that go with raised tension, vertigo and tinnitus. Women are undoubtedly affected more than men, and if the disease occur in them before fifty, menorrhagia will be common. If there be any doubt as to the nature of these cases, the judicious use of thyroid feeding will soon clear it up. This, if done without good results, involves no risk. Speaking generally, all these troubles can be much relieved and can often be cured by thyroid feeding, but the treatment in most cases will have to be continued for the rest of life. After the symptoms have mostly passed away, five grains of the extract twice a week is often sufficient to maintain a fair degree of health. Not infrequently we are brought to what appears to be a deadlock, by the action of this remedy on the

heart. A certain number of patients will get cardiac pain, an irregular pulse, and perhaps giddiness; often they have insomnia. They think they cannot go on with the treatment. In such cases, I believe, a low arterial tension will be found, and if so, suprarenal extract given at the same time will remove these discomforts. Ten grains of suprarenal and five grains of thyroid daily will act well together.

The following is a case in point. A lady, aged fifty-eight, showed many of the minor symptoms of hypothyroidism; and was putting on weight so fast that her breathing became much embarrassed. On five grains of thyroid extract daily, she rapidly lost weight, and at first felt better. The puffiness of the lower eyelids passed away, and her hair, which originally had been a bright auburn, and had become dull and rusty, regained all its gloss and colour. After three weeks' treatment she developed all the cardiac symptoms I have enumerated, and insomnia. I found her tension 120mm. only. She took ten grains of suprarenal extract daily with the thyroid, and all the disagreeable symptoms passed away.

In all cases of thyroid treatment, the arterial tension should be watched, and should

be the guide to the increase or decrease of the dose. When once one's eyes are opened, it will be surprising to find how much hypothyroidism enters into the maladies of middle age. Besides the symptoms described, there are also occasionally symptoms of profound nervous disorder. The following is an instructive case.

A lady, aged fifty-six, whom I had not seen for some years, but who, I think, had been inclined to myxœdema all her life, collapsed suddenly; she lost nearly all power over her limbs, so that she could not stand; the reflexes were, perhaps, slightly exaggerated, but her sphincters were for a time quite paralysed. Swallowing was not affected. She developed very soon a bed-sore, and appeared to be dying from prostration; arterial tension was 165 mm. After trying strychnine for a few days without result, I put her on to thyroid feeding only. In a few days her sphincters had recovered, the bed-sore healed, and she has made a good recovery. Her friends say that her mental condition is better than before her illness. In this case moderate thyroid feeding will probably have to go on for years.

In women it is especially about the menopause that we shall find the minor symptoms

of hypothyroidism; at the same time often we shall find early symptoms of arterio-sclerosis and of high blood-pressure. With this knowledge in our minds, we ought to be able to steer many a delicate woman safely through these troublesome years. The injudicious use of strong nerve tonics and of nerve sedatives in these cases often does more harm than good. Before using them the state of the thyroid and of the arteries should be tested. In those cases of hypothyroidism where there is subnormal blood-pressure, we often find a very poor state of venous circulation, as evidenced by cold feet and hands, with the fingers and toes blue, and with chilblains often. The vitality is generally low. Here much benefit is obtained from the addition of suprarenal extract to that of the thyroid, and by giving freely calcium salts. With regard to these calcium salts Rendle Short says: "It has long been recognised that they are essential to the continued success of perfusion fluids, and now we know that they control the coagulation and viscosity of the blood and probably the functions of the ovary and parathyroid glands also."

Remarkable results have been obtained in

many cases by giving calcium lactate in 15-grain doses three times a day (on an empty stomach) for three days only in the following conditions: transient or functional albuminuria, lymphatic headache occurring in anæmic girls, in urticaria, in chilblains and in all varieties of tetany. The symptoms of the menopause are sometimes greatly relieved by this salt.

When one considers how much the thyroid and parathyroid glands are concerned with calcium metabolism, we must realise how much assistance they may give in the circulatory troubles of thyroid disturbance.

As we pass on to real old age we often find the symptoms of hypothyroidism more marked and of graver import. We are only beginning to realise how much senility depends on internal gland insufficiency. Biedl says: "A special pathogenetic significance is ascribed to thyroid insufficiency in the changes which occur in later life, and which are included in the term senile degeneration. The foundation for the theory that old age results from changes in the thyroid gland lies in the fact that in old age the thyroid becomes atrophied, its follicles shrink, and retrogressive changes take place in the epithelial cells. This is re-

inforced by the fact that there is a profound analogy between the signs of advanced old age and those of myxœdema. The falling of the hair and the dropping out of the teeth, the dry and wrinkled skin, the lowered body temperature, the diminished perspiration, the indolent digestion and consequent emaciation, the reduced metabolism, the atrophy of the sexual organs, the decrease of mental power, and the diminution of the activity of the whole nervous system—these are all symptoms which characterise chronic myxœdema. Horsley holds the view that senility is due, at any rate in part, to thyroid degeneration, while myxœdema may be described as a condition of premature senility." Biedl concludes by saying: "We have not sufficient grounds for the assumption that senile decay results from the suppression of function of internal secretory organs other than the thyroid. The pathogenesis of this condition offers a wide field for investigation." With this clue to guide our researches and observations it ought surely to turn out a most fruitful field. The mere prolongation of life were an object scarcely worth the seeking if we could not at the same time hope to preserve the strength of

body and mind. There is no pleasanter sight than old age free from bodily suffering and with mind serene and mature; and there is no more distressing sight than old age borne down with infirmity and with the mind clouded and unhappy.

By nature an incurable optimist, I cannot help thinking that these investigations and discoveries will result in great amelioration of the troubles of senility, and in the prolongation of healthy life. As an example I give the following case. "A man aged eighty-five, who for some time had shown early symptoms of brain degeneration, suddenly, after a tiring day, collapsed. He was almost unconscious, and lay prostrate on his back. For days he could hardly swallow, the power over both sphincters was completely in abeyance; bed-sore commenced, and he looked a hopeless, dying case. Yet there was no true paralysis, no hemiplegia, no absolute aphasia; he could just move every limb if pressed to do so. Reflexes were present, but feeble. Arterial tension was 165 mm. As a forlorn hope I gave him thyroid extract, 5 grains daily. He at once began to improve; in a fortnight all incontinence was gone, he could swallow

well, and the bed-sores promptly healed. After three months' continuous thyroid treatment he could walk two miles daily, his tension was down to 140 mm. and his mental condition was improved also. No other medicinal treatment was given, and I think thyroid may fairly claim the honour of the results. In many cases of bladder weakness in old age, where there is partial incontinency, thyroid gives much help, especially perhaps after paralytic strokes. In old men with enlarged prostate we see no rapid effects, but there is evidence to show that thyroid feeding controls and lessens the growth of the gland itself, and so in time relief may come; where there is no prostatic enlargement and where good results, it must affect, I think, the innervation of the bladder. When we learn to use this remedy more scientifically and in fitting doses, I feel sure that we shall have far more control over the maladies of old age, and over some of their mental disabilities also.

In childhood there is also a large field for its use. In the enuresis of children and young adults thyroid rarely fails to cure, but in rare cases enuresis is caused by it or increased. It is well borne in youth, and seldom produces

the distressing cardiac symptoms that we find later in life; even in infants it can be given safely and with good results—for instance in some cases of infantile eczema. There is a great opportunity for its use, I feel sure, in cases of arrested development both of mind and body. In childhood we occasionally see two types of myxœdema; one congenital, showing itself in infancy, and not due to disease, but to entire absence of the thyroid. These cases resemble in their symptoms those in which the thyroid has been entirely removed; they are very severe, and are accompanied always by dwarfism and idiocy; in these little but temporary good can be expected. The other type—called not very happily infantile myxœdema—shows itself about the fifth year. It is much like adult myxœdema, and is clearly due to atrophy of a thyroid gland that has been present. Here thyroid treatment may do much good and even wake up the atrophied gland to new life.

Hypothyroidism is probably the foundation of the condition known as infantilism, the chief features of which are the persistence of infantile characteristics in mind and body. The above three morbid conditions show the extreme

results of athyroidism and of hypothyroidism, but there are innumerable cases, most of them unrecognised, in which partial and often temporary arrest of mental and bodily development is caused by thyroid deficiency. There can be no doubt that the healthy state of this gland, in conjunction with the pituitary, is very largely responsible for normal growth and development. In watching the growth of a young animal, a colt, for instance, we see him at one time—to use a slang expression—all legs and no head, in another month or so he is all head and no legs. Growth and development, mental and bodily, even in healthy children, seem often to progress in jerks. It is in these cases that the judicious use of thyroid and sometimes of pituitary extract will often tide over difficulties. A wise schoolmaster or mistress should, if the circumstances and theories be explained to them, be a very good judge of the need of thyroid and of its value. Many an apparently hopeless child will wake up into mental activity under its use.

In young girls at the age of puberty or soon after, in whom there is amenorrhœa or dysmenorrhœa (not due to some mechanical cause) it will often put everything right. It will

be no exaggeration, I think, to say that in amenhorrhœa, not obviously due to chlorosis, thyroid is the most successful remedy. Further —which is a very important matter for the future of every woman—it promotes complete and healthy development of the whole sexual apparatus. In mental disease, especially in asylum practice, where the symptoms can be carefully watched, I feel sure that internal gland remedies will show very happy results. The variations of arterial tension from the normal that occur in melancholia, where the tension is often very high, and in acute maniacal conditions, where after the attack it is very low, can often be corrected by the careful use of thyroid, suprarenal or other gland extracts.

In Graves' disease, which in the main we must look upon as due to hyperthyroidism, we have a most interesting and instructive subject for study. Without going into experimental evidence I take it as proved that here there is not only, in most cases, enlargement of the thyroid, though this may be very slight, but always increased functional activity and increased output of the active thyroid principle (which Schäfer calls thyrine) into the blood.

The symptoms of this disease can be all more or less produced by excessive doses of thyroid extracts. To take the nervous system first: The tachycardia, which is always present, is due probably to increased irritability of the sympathetic nerves caused by the excess of thyrine in the circulation, and chiefly perhaps to irritation of the *nervus accelerans* of the heart, which belongs to this system. The autacoid of the thyroid may be taken to be a hormone increasing the excitability of nerve cells, while the autacoid of the parathyroid has the opposite effect. The other nervous symptoms in this disease can largely be attributed to increased excitability of the sympathetic, the flushings of the skin, the perspirations, the slight rises in temperature and the general mental condition.

But there is another consideration. We know that thyrine is a hormone to the suprarenals and increases their output of adrenine; this is conclusively proved by experiments on animals. In this disease, therefore, we have an increase of adrenine in the blood as well as of thyrine. This again affects the sympathetic system in various ways. The blood pressure in Graves' disease varies considerably, not only in different

cases but at different times in the same patient. This is most probably due to a fight that is ever going on with varying fortunes between the thyrine in the blood, which is a depressor, and the adrenine, which is a pressor. The cases which show a rise of tension form, I think, the majority. It may be that the good effects of adrenal treatment in Graves' disease will be seen only in the low-tension cases, but my experience is that all cases benefit by it to some degree. Schäfer, referring to the excitability of the sympathetic seen in Graves' disease, says: "Here the question arises: Is this a direct effect on the sympathetic system, or is it indirect through the adrenals, which are stimulated to increased secretory activity by excess of thyroid in the blood? The answer is not easy. But it may be stated that although certain symptoms of hyperthyroidism are similar to those produced by excess of adrenine in the blood, others are not so. This is the case with flushing of the skin, which is due to vascular dilatation, whereas adrenine ordinarily produces vaso-constriction. Further, excess of adrenine in the blood leads to glycosuria, which is not as a rule seen in Graves' disease. Moreover it is undoubtedly

the case that the administration of adrenine exercises a markedly beneficial effect in some cases in this disease—a fact which would be inexplicable on the theory that the results of hyperthyroidism are simply due to excitation of the suprarenals and to the production of an excess of adrenine." As long ago as 1897 Lauder Brunton, in a clinical lecture at St. Bartholomew's, drew attention to the good effects of suprarenal extract in Graves' disease, but since then the question has been allowed rather to lapse, till Gibson of Edinburgh revived it. I am purposely using the designation " Graves' disease," in place of exophthalmic goitre, which is a most misleading expression, for the disease may exist without either exophthalmos or goitre, and which also distracts the attention from the true cause. Of the benefit derived in very many cases from the administration of suprarenal extract I have no doubt, and I have used it for many years, long before I could give a reason for the faith that is in me. It is a puzzling problem, however, and gives rise to much thought and conjecture. Is the exophthalmos, which occurs so often, due to hyperthyroidism or to hyperadrenalism? To the latter probably, I think. There

is room for much accurate observation here. Are the exophthalmic cases accompanied by high tension or not? Can one, when giving suprarenal extract, neutralise its tension-raising properties by combining with it depressor remedies such as the hippurates or the nitrites, and by so doing produce a fairly normal state of tension? The answer must, I think, be 'Yes,' and in all probability it is an advantage to the patient to do this, for the wear and tear of the heart becomes less and probably also the nervous restlessness. I have often thought the use of strophanthus combined with this suprarenal treatment to be a considerable help in slowing and regulating the heart's action. Do the cases which go from bad to worse show generally a high arterial tension or a low one? The latter are, I think, the worse, for there is a failure probably of the suprarenal output and so of its compensatory action.

Looking at the disease from the nerve side, would not parathyroid feeding be of use in controlling the sympathetic over-excitability? Probably yes, but I think the combination of parathyroid and suprarenal extract will be of more use. Finally, the thyroid and the

suprarenal glands are, as we know, in many ways opposed to one another in the properties of their active secretions. The thyroid has a hormonic or stimulating effect on the suprarenal secretion : is it unreasonable to think that the suprarenal may have a chalonic or inhibiting effect on the thyroid ? If this could be experimentally proved much light would be thrown on these problems and the efficacy of this treatment explained. These are questions that I hope my readers will try to answer for themselves, for I feel that my knowledge and my opportunities for observation are quite insufficient. To look on Graves' disease as purely a condition of hyperthyroidism would be a very narrow and misleading view. The whole morbid state is so bound up with the sympathetic system, with the suprarenal system, and to a certain extent also with the internal secretory glands of the sexual system, that it is very difficult to fix the initial point of aberration. The fact that this disease occurs chiefly in women, that it has apparently come on frequently as the result of some mental shock or emotional disturbance, and that in women it exists almost without exception in the years of their sexual activity only, point

rather to a sympathetic nerve origin than to a glandular. We must not forget also that the nerve disturbance is so great, that not a few of these sufferers pass on into real mental disease. Of this I feel sure, that if we continue to take a large and wide view of the whole subject, and if we use all the knowledge that physiology and experimental research can give us, we shall be able to go very far towards the cure of this distressing disease. I must go further and say that, always supposing that we have opportunities for seeing thyroid disease in its early stages, the full development of Graves' disease and of myxœdema should be preventable and should be looked upon as among the opprobria of medicine.

There remain for consideration the two external methods of treatment: partial excision of the gland, and X-Ray treatment. Kocher, who has done very many cases of excision, says that if a quarter of the gland is left, good results are obtained and no evil ones; but have surgeons the opportunities for watching their patients, not during the ensuing months only, but through the ensuing years? The transition from hyperthyroidism to hypothyroidism is so easy and so frequent, even

where there has been no excision, that to prove their case, surgeons should give very careful statistics not of immediate results only but of the condition years afterwards. For the time being they may have crossed the river of their difficulties, but they have burned their boats.

To a certain extent the same remarks apply to X-Ray treatment, for that without doubt can be carried too far—there is one case on record where complete atrophy of the gland ensued—but I think that in wise, skilful and cautious hands, this method will be of great help to the internal and general treatment. There is one point in the management of these cases on which I have not laid sufficient stress, and that is the all-importance of rest. This is an easy thing to order but very difficult to carry out, for these patients are oftentimes so restless and emotional, that there seems no rest in them; still the lesson must be inculcated, in season and out of season. Dr. Leonard Williams prescribes, I believe, a broken leg, but that is an ideal treatment for the most part unattainable. In addition to as complete rest as possible, we may sum up the indications for treatment, as far as our present knowledge

goes, thus: The central causative error being still unknown, it remains for us to attack the more patent objective conditions of disease; these are the enlarged pulsating thyroid, the rapidly beating, irritable and often dilated heart, and the excitability and instability of the nervous system. The first can often be lessened by X-Ray treatment, and this with the heart symptoms can be successfully attacked by the internal use of suprarenal extract—three or four 5-grain tablets may be given daily—if there be marked dilatation strophanthus will give good help to the suprarenal; digitalis is very rarely useful. If arterial tension be high—over 160 mm.—the hippurates or the nitrites will help to quiet the action, but tension should never be reduced below 135 mm. Lastly, the nervous symptoms should be relieved by the internal use of parathyroid extract (this can now be obtained in tablet form, gr. $1\frac{1}{2}$). In my opinion the parathyroid and the suprarenal treatment should go together. I think it is a mistake to quiet the nerves by bromides and narcotics; the symptoms are only held in abeyance, and the patient's natural recuperative powers are probably weakened.

In the suprarenal gland we have another most interesting field of study. As we all know, this gland is composed of two portions, the cortex and the medulla. Physiologists are still in doubt as to the properties of the former, though their speculations are full of interest. In the medulla, from which we get our suprarenal extract, the cells peculiar to it are derived from the same tissue, morphologically, as the ganglion cells of the sympathetic. Elliott graphically says: "The adrenine cells and the ganglion cells are closely related stations on the great sympathetic highway that reaches from the central nervous system to the blood-vessels. The adrenine cell is essentially a part of the nervous system, and in reality not a peripheral cell at all." But apart from its nerve connection and influence this gland has a chemical action which seems to be independent of its nerve action; this exists in its chromaffin tissue, which Noel Paton describes thus: "The chromaffin tissue may be defined as a tissue composed of cells derived from the nerve cells of the abdomino-thoracic sympathetic system, which stain a brown colour with chrome salts and which produce a physiologically active substance called adrenine." This sub-

stance can be produced synthetically. When injected into the blood-vessels it stimulates the terminations of the true sympathetic in visceral muscle and in glands, and it acts on these terminations alone. That adrenine has a double way of action is proved by the fact that all the nerves of the sympathetic group may be removed and yet the animal will live; but if the glands themselves are removed the animal inevitably dies, showing that the passage of adrenine into the blood stream is necessary to life. It is important, in investigating the range of action of this internal secretion, to remember this. Elliott again says: "Adrenine has the remarkable power of stimulating only that plain muscle in the body which is supplied by the sympathetic nerves, and the action produced by it is always identical with that caused by electrical stimulation of the nerves. The chemical substance circulating in the blood evokes exactly the same response as does the nervous impulse—each reinforces the other." To use a homely simile, this front- and back-stairs passage for its influence shows its great importance in the animal economy.

The suprarenal glands are very richly supplied with nerves from the splanchnic direct,

and from the suprarenal plexus. It is probably with one exception the most vascular organ in the body. The following is a short extract from Schäfer's lecture: "If an extract of suprarenal capsule be injected into the vein of an animal, the first effect is an immediate and marked rise of blood-pressure; this can be shown to be caused by contraction of the peripheral arteries. Along with this contraction a slowing of the heart's action may occur, due to an effect on the cardio-inhibitory centre, and this may limit somewhat the rise of blood-pressure. But if the vagi are cut or paralysed by atropine, the heart's action becomes very accelerated, and also augmented in force (primarily by the action of the autacoid on the auricles but also somewhat on the ventricles), and this greatly increases the rise of blood pressure. The effect on the vessels lasts a few minutes, passing off gradually; afterwards the blood pressure is usually a little lower than before. The arteries which are most affected are those of the splanchnic area; those of the limbs and trunk rather less, although the cutaneous vessels are often strongly contracted; those of the pulmonary system and of the brain only very slightly, if at all, and those

of the coronary circulation not at all. It is always the smaller vessels that are most affected, and in consequence of the great rise of pressure which their contraction produces, the larger arteries tend to become passively dilated; this dilatation may be very great. The effect upon the vessels is seen after complete destruction of the central nervous system, and after severance of nerves to the part. It is, therefore, due to a direct action of the autacoid principle of the gland on the contractile tissue of the heart and vessels; nevertheless such action only occurs in tissues which are supplied by the sympathetic system, and severance of the nerves, so far from stopping the action, tends to make the tissues supplied by the severed nerve more easily excited by the autacoid. Gunn and Chavasse have shown that adrenine has also an action upon the muscular coat of veins, causing tonic contraction in peripheral veins and rhythmic contraction of the superior vena cava near the heart."

To arrive at the wonderful and beneficial results that may be obtained clinically from this powerful extract, one must think very deeply over all these physiological experiments and results. We have evidently a weapon that

may be powerful for good or for evil, and one that must be used in accordance with our reasoning powers and our knowledge. Elliott says in his eloquent way: "The adrenal glands, whether medulla alone or cortex and medulla, are concerned in maintaining the steady tone of all muscles innervated by the sympathetic nerves. They are responsible day by day for the upholding touch that maintains the driving power of the pulsating current of blood by which we live. The nervous impulses, which play upon these muscles, merely serve to change the tension up and down, here and there, where special circumstances require more delicate adjustment to local and peculiar needs of the body."

We have, then, before us the power which by way of the blood and by way of the sympathetic activates and controls the energy of the heart muscle and the force of its contractions, and which also controls that most important property, the tonicity of the muscles of the heart and of the arteries. When we learn how to use this power wisely and in accordance with physiological laws, we shall have probably the most effective heart tonic in our repertoire. To compare it accurately with

digitalis takes a better pen and mind than mine, but one may briefly say, I think, that digitalis acts firstly as a tonic on the vagus roots, and so on the inhibition of the heart, and that adrenalin acts chiefly and firstly on the sympathetic system and so on the stimulation of the heart; the one on the vegetative nervous system, the other on the autonomous. Both remedies, if pushed too far, extend their action to the other division of the nervous system, and in poisonous doses produce results quite opposite to their primary ones. If we have an open choice of remedies, I think we should choose the ones that already belong to the animal system. Just now we are perhaps unduly prejudiced against aliens. They have been very useful in the past, but I think the time has now come for the use and protection of native goods and industries. One cannot help feeling that the foreigner has something harmful up his sleeve. In ordinary practice intravenous injections are not possible, so we must consider only the hypodermic and the oral method of administration. Some authorities say that adrenalin given hypodermically takes a long time to get into the circulation, but if one has watched the rapid relief

that it gives to spasmodic asthma one can hardly accept this statement. No doubt the local astringent action delays its absorption somewhat, but I think this may be got over by combining with it 2 minims of liq. trinitrin, and by further dilution. One may make an interesting speculative study of the effects of adrenalin and of chloroform narcosis on the heart. If adrenalin be given in too concentrated a form there is often a period of half a minute or more when the heart's action, instead of being strengthened, wobbles and has a halting gait, and the patient becomes pale and faint; in the same way there is often such a period of uncertainty at the commencement of chloroform narcosis. Can these effects be accounted for thus? Under chloroform the chief control of the heart, in French *l'ordre supérieur*, passes from the vagus, the servant of the vegetative nervous system, and is taken up by the sympathetic, the servant of the autonomous system. The same happens, I think, when we give a full dose of adrenalin. It is in this transition period, when the gears are being changed, that danger is present. This has been overcome to some extent of late years, in anæsthetic work, by giving an injec-

tion of morphia and scopalamine or of morphia and atropine shortly before the chloroform. The effect of this is partly to paralyse the vagus and so to put it out of action. This makes the change of gears more rapid and easy. In the same way, I believe, the addition of atropine or scopalamine to adrenalin would produce a safer and more rapid effect.

My physiology may be wrong, but I think my facts are right.

To return to the practical point of adrenalin dilution. This case illustrates my point. A clever, observant woman, who has spasmodic asthma very severely, finds her only relief from hypodermic injections of adrenalin. She was at first told to use eight to ten minims neat; each time she felt very faint, and became so pale that her relations begged her to give it up. By diluting eight minims with twelve of sterilised water these bad effects never occurred and the good effects were continued.

To show the far-reaching effects of the suprarenal secretion, and as an incentive to the deeper study of its possibilities, I give Dr. George Murray's words from his article in the *Practitioner* of February 1915: "It has been shown clearly by the investigations of Elliott,

Cannon, and others, that under the influence of a strong stimulus, such as fright, adrenine is rapidly discharged into the adrenal veins and so into the general circulation. It is interesting to follow up the effects of this condition of adrenalæmia and to see how useful they may be to an animal either in contending with or escaping from the cause of fear. The excess of adrenine dilates the coronary arteries, giving the heart a larger supply of blood, increases the strength of the cardiac contractions, and raises the blood-pressure. It tends to divert the chief flow of blood from the abdominal vessels to those of the central nervous system, heart, lungs, and muscles. The adrenine thus stimulates just those activities which an animal employs either in fighting a foe or in escaping from an enemy. In addition to this, the adrenine mobilises the store of glycogen in the liver, thus increasing the amount of sugar in the blood and rendering it available for use in the muscular action entailed by the effort."

Transferring the consideration of these facts to our own more placid lives, may we not discover many analogies and aids to help us in the fight against disease, and methods of

escape also from the attacks of our microbic and other enemies? This force is ever quietly working to maintain and protect us; it must be our aim to support this friendly power, and to supplement it if need arise. We see in Addison's disease, how the destruction of this organ and the consequent absence of its secretion soon ends in progressive debility and death, but also we see that from the same cause our defences are broken down and the body lies open to any attack. In not a few other acute diseases, such as diphtheria and cholera, the suprarenal secretion is partly or entirely suppressed, and this is probably one of the chief causes of the muscular and cardiac weakness, and of the loss of arterial tone that so often seems to be the cause of death. In all these diseases suprarenal extract or adrenalin injections have already proved very useful. In pneumonia especially, a falling blood-pressure should be the sign for the use of this remedy, and it should be given freely and continuously. In addition to its good effect on contractility and tonicity, it is in many cases a good timer of the heart. I have seen cases of auricular fibrillation yield to it when digitalis has failed. Its rather unexpected action

on spasmodic asthma is not easy to explain, but it is probably due chiefly to its stimulating effect on the sympathetic nerve endings and by this effect overcoming the muscular spasm, arising from over-action of the vagus. Its power of dilating the coronary arteries may also be a factor. The local action of adrenalin is so well known that I need not touch on it.

There remains the question of the mode of internal administration. To give the liquor adrenalin would at first sight seem to be the easier and the more scientific way, but as a matter of experience it is found that it has in most cases but little general effect when given by the stomach. Grunbaum says that even in doses of 60 minims it fails to raise the blood-pressure. The explanation probably is that it has such an astringent or blanching effect on the gastric mucous membrane that absorption is very slow. This local effect is very valuable in cases of hæmatemesis. At present we can best get the effects we aim at by giving extract of the gland, and this is best given in the tablet form—five-grain tablets may be given every two hours in emergencies. The manometer will always show when enough has been given. Some writers say that this

method is ineffectual, but that is quite contrary to my experience, and we must remember that Oliver and Schäfer's original experiments, which have so largely led to our present knowledge, were made, as Dr. Oliver has himself told me, with teaspoonful doses of a strong glycerine extract or emulsion of the suprarenals of the sheep; it therefore seems probable that large doses are required to produce their physiological results, and here, as so often happens, want of courage leads to want of faith. The ideal method, of course, in emergencies especially, is by intravenous injection, but, except in hospital practice, that is rarely possible.

One more gland remains for special notice—the pituitary. In recent years the powers of this gland have been recognised as very remarkable, and apparently neither life nor health can exist for any length of time when it is destroyed. The anatomy, position and histology it is needless for me to describe, but a careful study of its structure will help towards a grasp of its physiological properties and possibilities. To make a brief summary, apparently as far as our present knowledge goes, the anterior or glandular portion is the part

essential to life. It is this portion also which governs the growth of the body, and particularly of the skeleton. The abnormal conditions of gigantism, infantilism and anomegaly belong, it is thought, to faulty conditions of this part. The pars intermedia secretes one or more hormones that affect the heart and circulation in the manner described below. They also increase the activity of smooth muscle and cause an increase of gastric, renal and mammary secretion. The active principles that affect the circulation are found more in the pars posterior, but it is believed that they are only passing through, from the intermedia, where they arise, to the third ventricle, and subsequently by that route into the cerebro-spinal fluid. Experimentally the effect of these extracts upon the heart and blood-vessels is a direct one, and is not due, as in the suprenal autacoid, to its stimulant action on the sympathetic nerve endings. The effect on the heart is also different; for whereas—with the vagi cut or paralysed—adrenine causes a marked acceleration of the heart (sympathetic stimulation), the pituitary causes a slowing of the heart's action along with increased force. Moreover, while adrenine produces

dilatation of the coronary vessels the autacoid of the pituitary constricts them, as it does other systemic arterioles, and the same is the case with the pulmonary vessels.

The interrelationship of this gland with the other internal secretory glands is very intimate and important, and is well worth study. The practical applications of pituitary extract that interest us, are firstly its effect on the heart and circulation, as described above, in which it has proved to be a very valuable ally to adrenine and to the digitalis group. Secondly, its action on the uterus. Here in obstetric practice it is most effectual. Schäfer says: "The uterus under its influence is rendered more excitable to influences reaching it through its nerves. Pituitary extract probably acts on plain muscle more by increasing its sensitiveness to normal stimuli, than by acting as a direct excitant. Thus, when given in pregnancy before the commencement of parturition it produced no effect, but its action during parturition is well marked." In cases of uterine inertia before and after birth it is probably the most rapid and powerful remedy that we have. Thirdly, in intestinal inertia and meteorism, that so often occur after

abdominal operations, this remedy will often restore the muscular tone, and will help much towards the expulsion of the bowel contents. Fourthly, its very valuable action on the kidneys as a diuretic; this has not been as yet fully worked out from the clinical side, but probably it will be of most use in the renal inadequacy of heart disease and in most forms of dropsy. Fifthly, it is a very powerful restorative in all forms of shock. Its good action on arterial tension is not repeated by a second dose, at any rate if given within a few hours; but on the heart muscle, the uterus, the intestine and the kidney it can be given frequently with good effect. Some writers claim that it has a good effect in Graves' disease, and its similarity in some respects to adrenine would certainly suggest its use. The oral use of pituitary extract has so far proved to be unsatisfactory. The active principle of the pars posterior seems to be destroyed by the gastric juice and to be inert. It is likely that the dried anterior part or an extract of it may be of use in arrested growth and development; I have seen one case in which it was certainly effectual.

Of the other glandular extracts I have little

to say from personal experience. The hormotone tablets of Carnrick's make, which are believed to contain extracts of thyroid, pituitary, ovary, testis, pancreas and spleen—a veritable six-shooter—are often a very effective nerve and mental tonic, especially perhaps in women. They must be carefully used and watched, as they distinctly raise arterial tension. Allen & Hanbury have a preparation somewhat similar which they call polyglaudin. Burroughs & Wellcome have introduced a happily named Didymin tabloid. This, in many women about the climacteric, has a very good effect, and in old men, too, I have found it very useful, but it may cause much excitement. As far as I can judge, it has the advantage of not raising tension.

Of the things, then, that we have spoken this is the sum. The old Romans in their deep wisdom and insight recognised an unseen force that in our bodies was ever fighting the battle of health versus disease, of life versus death. This they called the "Vis medicatrix naturæ." Of this power till now we have known but little more than this happy name. Harvey's discovery of the circulation of the blood was an enormous advance, but was no solution of

the mystery. But when we ponder on these internal glands, their secretions, which are essential to life itself, their intimate correlations and their extraordinary powers, we are tempted in the first flush of our enthusiasm to cry out, like St. Paul to the Athenians, " That power, that vim, which ye ignorantly worship, that declare we unto you." And yet, on deeper reflection, we come to feel that it is still not the power that we see, but only the Great Architect's marvellous mechanism; and so we become humble again. Our knowledge has grown immeasurably, our usefulness has grown, and with them our wonder and our worship. In scientific language, Biedl sums up the present position of our knowledge thus: " Two agents are concerned in ordering and maintaining the complex activity of the animal organism; in addition to the nervous communication, which admittedly is the agent in effecting rapid readjustments, there is also a chemical correlation of the different organs; in accordance with the latter, each organ, each tissue, and even each cell by means of its specific secretory products, acting through the agency of the blood-stream, is enabled to exert a specific influence upon other parts of the body.

In this manner the equilibrium of the various parts is maintained."

In simpler but more poetical language St. Paul expresses the same truth : " And whether one member suffer, all the members suffer with it, or one member be honoured, all the members rejoice with it." The condition, then, that we call perfect health implies a perfect balancing or equilibrium of all our organs and powers. To maintain this balance, or to regain it, if it be for a time lost, is mercifully the Divine order, the implanted tendency in all. We may so fight against or ignore the laws of Nature that this balance is never perfect, and it is thus that chronic disease arises and gains the mastery.

The strange and unexpected results that we sometimes see arise from so-called faith healing and Christian Science, can, I think, be thus scientifically explained. Under the influence of great emotions, of joy or hope, and also of religious fervour, some of us seem to have the power of calling on our dormant reserves and of increasing the output into the blood of all our home-made autacoids ; this often results in improvement of health, and in some cases even of cure. It is surely not for us to throw

on poor struggling mortals the cold douche of cynical semi-scientific scepticism, but rather to encourage them in their spontaneous efforts, and to let them see that we can supplement their their own natural powers from outside.

With this new knowledge of the " Vis medicatrix," of its mechanism and of its chemistry, we must realise that our control over disease is enormously increased, and that there is a far brighter and less suffering future for the sons of men.

Whether this essay will have on the minds of my readers a hormonic or a chalonic effect I know not, but I venture to hope that the absorbing interest of the subject will cause them to forget or at any rate to forgive the shortcomings of the writer.

IV

CHRONIC BRONCHITIS AND BRONCHIAL ASTHMA

THE MICROBE.—"*Apologia pro Vita Mea.*"

Blindly we seem to labour,
Whether for good or for ill;
The all-seeing God who made us
Knows we are working His will.

Patient unceasing toilers,
In the welter of growth and decay
We further the infinite purpose
Of His wondrous alchemy.

IN this essay I propose to deal with chronic bronchitis and its frequent sequel, which is generally called bronchial asthma. The disease called pure spasmodic asthma, which may begin at any rate without bronchitis, I shall only mention incidentally. Especially in the large cities with impure, smoky atmospheres, this disease, as we all know, gives us a large part of our work, and often gives as much worry and discontent, but that is of little consequence compared with the wretched health and the crippling of work and energy that it causes in

our patients. It leads also, without saying, to shortening of life. The original causes are not always the same. It may begin by frequent attacks of simple catarrh, it may begin from influenza, from slight attacks of pneumonia or bronchitis, or it may be caused by continued inhalation of irritant particles or gases. Among men and women who have to live and work in unhealthy surroundings, we have to fight this disease chiefly in its own lair—change of air and work are rarely possible—and this is a fight which needs all the weapons that modern science can give us, all our patience and all our skill; but when one considers the results, it is a fight worth the fighting.

Whatever the original cause of this condition may be, we find that in almost every case we have a microbic infection to deal with. It is very rarely indeed that one finds the sputum sterile. The microbes that we find are chiefly—and I am trying to give them in the order of their frequency—M. catarrhalis, pneumococcus, and one or other variety of staphylococcus or of streptococcus; the Friedlander is also occasionally found. When one has treated these microbes with autogenous vaccines, and has watched and weighed the

results, one must, I think, arrive at the conclusion that they are the chief causes that maintain and perpetuate the chronic disease. I am by no means claiming that we always get good effects from this treatment, but the number of cases that are either cured or much relieved is so great and so far in excess of the failures that I can come to no other conclusion. In fact, I have almost come to the further conclusion that failure is the result of some error either in selection of the microbes or in the technique of the preparations. The numberless cases that have been cured by this method during the last few years should encourage us to further scientific investigation, and the failures should only serve to show us our defects.

There is one point that I must emphasise in this place—that is, the importance of a good, careful bacteriologist. The preparation of these vaccines, if done in a careless, haphazard way, will only lead to failure and disappointment; and, what is perhaps worse, will cast a stigma on us and on that subject of pride, our medical science. I am not speaking like this without reason, for even in large, well-known bacterial laboratories I have known

very poor work done. I am inclined to think that private workers, and if possible qualified medical men, will oftentimes make better vaccines than institutions, where individual watching is often impossible. As an example, we who have any considerable experience of these methods must have come across cases which have been cured by one man's vaccine when another man's has totally failed. It is perhaps hardly necessary to say that all vaccines for this disease should be autogenous, and yet I have known stock vaccines to be sent out and recommended as equally good.

Hitherto I have been looking at this disease from the point of view only of the invader, and I have been considering only the destruction of the enemy by our artillery. The wise physician will soon see that this is only part of the problem. The patient who has unluckily got the disease is really the man who has to do the fighting ; we can help him much by attacking the enemy from without, but we must also teach him and help him to put his natural defences in order. Strictly speaking, we must look on these poisonous bacteria as foreigners, but as a matter of fact they are almost always with us. Very rarely does a

microscopical examination of the mucus of the nose or mouth fail to show the presence of one or other of them, even in health. Our natural powers of resistance, our internal secretions and our phagocytes are generally able to deal with them effectually, and to ward off their importunities; but it is when these powers fail or are caught napping, when the bacteria multiply by millions and there is nothing to destroy them, when they pass out of their place and invade the internal organs, that disease is established. The prevention of this failure of resisting power must be our first aim. Overwork, intemperance, improper feeding, exposure to damp and chill, all tend to lower the vitality, and to expose us to attack. These we must fight as best we can and as circumstances allow. The enemy is always round the corner waiting for his chance. It is to our frontiers that we must always be looking.

Our most vulnerable points are probably the nose and mouth. The nose in health should act as a dust and germ filter so effectually that no live germ should gain entrance into our system, but the mucous membrane of the nose, especially in impure atmospheres, often becomes irritated and thickened, and proper nose breath-

ing becomes a difficult thing; then mouth breathing becomes more or less a habit. This, though a natural passage for air, is not an effective filter. One sees how very liable children with adenoids are to bronchitis and bronchial asthma. The nose, then, is the first point to attend to. The physicians and surgeons who have devoted themselves to this branch of work can often give us great help, by restoring a proper nasal passage and by attention to the tonsils. There is often a congested tender spot in one or both nostrils, which seems to act as a centre from which proceed the nerve storms that cause spasmodic asthma. Here, also, hay fever seems to originate. This spot needs great care in treatment, and harm can easily be done; but some of our chief specialists, by their skill, produce in these cases something like a miraculous revolution. Our largest frontier, of course, is the skin, and this many working folk habitually neglect. Their work often causes sweating, and the skin that sweats needs careful washing and protection. They often wear clothes that do not absorb the moisture, and so, when work ceases, their skin is in contact with a damp, chilly material. Much may be done by bathing and after-rubbing

with a rough towel, to keep the circulation of the skin in a healthy resisting state. Bronchial folk, as a rule, cannot stand a cold bath, and a hot bath often relaxes the pores and leaves them liable to chill. The best plan is to thoroughly wash and soap in hot water and then, standing up with the feet still in the hot water, to have two or three good sponges down with cold water, beginning at the head. This produces a good reaction of the circulation and is a pleasant stimulant. The clothing should be not too light, nor so heavy as to produce perspiration when not at work. Light woollen materials are, I think, the best, but some of the modern cellular makes of cotton seem to answer well.

It is clear, then, that any one with a tendency to bronchial catarrh or asthma needs to lead a most careful and watchful life; he is incessantly almost open to attack from hostile germs, and every chill weakens his defences. We, on our part, can do much to help these cases by looking to the heart and blood-vessels, the digestion and the kidneys. Many of these patients, especially in middle life, have overstrained, dilated hearts, and often some degree of arterio-sclerosis, and there may be early

kidney trouble. The action of the liver often is sluggish and the organ may be congested; this, of course, causes indigestion and the flatulence which bothers many of them so much. Careful attention to all these points will help much towards cure, especially in conjunction with the vaccine treatment. To gain real success the old therapeutics and the new must go hand in hand.

There is a distinctly gouty form of chronic bronchitis which often alternates with true gout and eczema. This, in the first instance, will only yield to appropriate gouty treatment: alkalies, sulphur, etc.; but even this form becomes bacterial in the end, and the sputum should always be examined. Most of the remedies (and they are almost innnumerable) that we have used empirically in the past have acted chiefly as bactericides—for example, the tars, turpentine, terebene, the balsams, the benzoates; the great favourite, iodide of potassium, acts probably in this way directly by its iodine and indirectly by stimulating the output of thyroid secretion. Chloride of ammonium, again, probably acts in the same way. Antimony, which in the acute early stages of bronchitis was our forefathers' sheet-

anchor, and which has fallen out of use far too much, is probably a bactericide (*vide* its action on trypanosomes). While carrying out the vaccine treatment, even if there be no cardiac complication, the patient will need helping in every possible way. Arsenic and iron are often very useful. The judicious use of internal secretion preparations will often help wonderfully. In cases with high tension and threatening arterio-sclerosis, thyroid will often bring about a better state of general health and help to reduce abnormal deposits of fat about the heart. In others suprarenal extract will do good, especially if arterial tension be low; in others one of the polyglandular preparations will raise the general tone and resisting power.

When we come to the practical use of vaccines, we have first to find out what the sputum contains—for there will rarely be only one enemy—and then to decide on a single or multiple vaccine. I think we must give pneumococcus the place of honour. He is as common as any and perhaps the most easily cured. It is very surprising how many cases of chronic bronchitis, with or without asthma, have pneumococci, even when there is no history

of any attack that one can suspect of being true pneumonia. One must, I think, come to the conclusion that many attacks of acute bronchitis are pneumococcic in origin, even when there have been no signs of lung consolidation or of rusty sputum. In the *British Medical Journal* of June 14, 1913, Dr. Pirie, in an article that is very instructive both to the physician and to the bacteriologist, gives the following statistics.

Bacteriology of sixteen cases of chronic bronchitis without asthma:

Pneumococci . . .	12 cases
M. Catarrhalis . . .	12 ,,
Staphylococci . . .	5 ,,
Streptococci . . .	6 ,,
Friedlander . . .	5 ,,

In sixteen cases of chronic bronchial asthma he found:

Pneumococci . . .	16 cases
M. Catarrhalis . .	16 ,,
Staphylococci . . .	8 ,,
Streptococci . . .	6 ,,
Friedlander . . .	6 ,,

The almost universal absence or non-discovery of the influenza bacillus, even with a clear history of a recent attack, is remarkable. The selection will, to a certain extent, depend on the predominance of one or other bacillus in the culture and generally speaking a multiple vaccine, with the possible exception of pneumococcus, is more likely to be effectual than a single one. The following is the experience of my son, Dr. Arthur Scott, who has for the last three years made most of my vaccines:

"Much disappointment and doubt as to the value of vaccines in chronic chest complaints is, I believe, prevalent among the medical profession. Yet I think that those medical men who have given them, in chronic cases, frequent and prolonged trial, become more and more convinced of their general value; I say general value, for one meets with many failures in cases which one thinks would promise well. Granted a definite curative value in vaccines, it becomes difficult to explain their complete failure in certain cases. Making an attempt to group these causes of failure, there is in the first place the unknown condition in some patients that negatives immunity: for ex-

ample, from an attack of measles one person becomes immune for life, another may get it again in a few months. It seems that there is a failure on the part of some patients to retain their anti-bodies in the system.

"In a second group, and it is a large one, the vaccine is at fault. In nearly all bronchial cases there is a mixed infection, and the difficulty in choosing from which bacteria to make the vaccine arises. Make a separate vaccine of all the likely bacteria present and mix them together is the apparent solution of the problem, but this entails making subcultures into several generations, and vaccines from subcultures have very little power of conferring immunity. Probably the most efficient way is to make a solution from the primary culture, then estimate the relative proportions of the varieties of bacteria to each other, by naked-eye examination of the cultures (this is rather guess-work), or where possible by examining a prepared slide of the solution. The predominating variety is then not subcultured, but the varieties occurring in smaller numbers are subcultured and added to the original solution in proportion to the dose required for administration. This method is

necessarily faulty, but not more so than the use of impure subcultures of all the varieties. Subcultures can only be obtained pure after several generations have been made.

"Often the method of sterilisation of the vaccine destroys its value: for example, a pneumococcal vaccine begins to lose its virtue when heated to 55° C., whereas a staphylococcal vaccine may not be killed at 60° C. This explanation shows that it is not necessarily the principle of vaccination that is the cause of failure, but often the so far insuperable difficulties of the bacteriologist. It is possible that in the future the X-Rays may help to solve some of these difficulties.

"In a third group error in administration is the cause of failure. The size of the doses and the intervals between them can only be determined by the patient's symptoms. The opsonic index will not help, as in bronchial cases it is a question of local or tissue immunity rather than of general immunity. Of more importance than all is the duration of the treatment. Most patients are not kept under treatment nearly long enough. It is to be remembered that the bacteria present are probably leading a saprophytic as well as a

parasitic existence. This I personally believe to be always the case in chronic bronchitis. Thus the organisms present are living not only on the bronchial epithelium but also on the bronchial secretions; these are, in the first place, set up by repeated bacterial attacks on the epithelial cells, which are then kept actively secreting by the irritation of the toxins, a vicious circle being thus formed. Hence, if both general and local immunity are obtained, it will not follow that the symptoms of bronchitis will at once disappear, for the saprophytic existence of the bacteria is not only active, but is waiting for lowering of immunity to attack again. For these reasons I think that vaccine treatment of chronic chest catarrhs, etc., should be continued for very much longer periods of time than is now usually done, so as to allow the bronchial epithelium to regain a normal, healthy condition. I believe that in old-standing cases of bronchial asthma treatment of less than two years' duration is of little use. The vaccines will not need to be given very frequently after the first six months: once a fortnight, or once in three weeks, is generally sufficient."

From my own experience I would further

say that in these long-standing cases it is good policy to have a fresh bacterial examination made every six months or so, and if the bacterial conditions have altered, to have a fresh vaccine made. One of the most successful cases I have ever seen is an old lady, now seventy-nine years of age, who lived out of England for many years in the hope of getting rid of persistent bronchial asthma. She finally came to Bournemouth to end her days as a hopeless case. She has been under treatment now for four years, having a vaccine, which is changed from time to time, every fortnight. Under this she has regained a very fair degree of health, and the bronchial asthma is almost cured. Age is no bar to this treatment. Quite old people of seventy-five to eighty-five do very well and get no alarming symptoms. Children also of two or three years old respond equally well. The most disappointing cases, perhaps, are in overworked, anxious, neurotic, middle-aged folk. Confirmed emphysema has, by some, been thought to be unsuitable for vaccines, but that is not at all my experience. On the contrary, I have seen bad cases of emphysema very much improved, and surely it is only what one would

expect; if catarrh, cough, and expectoration are lessened or cured, the lung substance has again a chance to recover its elasticity. As I have said before, pneumococci cases often respond quickly and well. Catarrhalis cases vary, but are generally rather obstinate, and it is not always easy to find the suitable dose to begin with. Too big a dose will sometimes increase dyspnœa. Staphylo cases are generally in conjunction with pneumococci or more often with catarrhalis, and a double vaccine often answers well. Streptococci cases will often need a long course, but do very well in the end. This microbe will not seldom be found with pneumococci. It is well to begin with a small dose, ten or fifteen millions, and to watch for symptoms of irritation such as increased cough or dyspnœa; a rise of temperature is very rare, and if it occur should cause no alarm. The smaller doses should be given every four or five days. When one has found the dose that does good, it is better, I think, to stick to it and to give it every ten days or so, till one has got the symptoms well under control, and then to carry it on at intervals of every two or three weeks for a year or more.

It is hardly necessary for me to say that all vaccine treatment should be carried through with strict antiseptic precautions. I find that washing the syringe and needle inside and out with a weak lysol solution is a quick and safe plan; the patient's skin should be cleaned with the same solution or with iodine. If lysol is left in the syringe more pain is caused than is necessary; so I wash it out, before drawing in the vaccine, with boiled water. The collection of sputum should be done in the morning, if possible, before food is taken, and the mouth should be washed out previously with hot water, not with any antiseptic wash. The sputum should be expectorated straight into a wide-mouthed bottle with glass stopper that has been sterilised by boiling the previous night, and should be sent with little delay to the examiner.

In many of these cases one will find high tension and early symptoms of arterio-sclerosis; this has been thought by some to contra-indicate vaccine, but my experience has, with these cases, been very favourable. The high tension, etc., has been to a large extent brought about by the continual strain of coughing and dyspnœa and by broken rest,

and the relief of these will alone lower tension. It is very common for old people who have had a chronic cough to die of a sudden unexplainable pneumonia, without any chill or exposure to infection: these cases are all latent pneumococcic affections. For some reason the resisting power has given way, and the invasion has taken place. Such cases could be easily prevented by the occasional use of pneumococcus vaccine, for the microbe could have been detected in the sputum of the chronic state.

Further, arterio-sclerosis is thought by many to be caused in some cases by auto-intoxication from the abnormal bacteria of the digestive tract; is it not reasonable to think that it may be caused also by auto-intoxication from the abnormal bacteria of the respiratory tract? Whatever the cause may be, you will generally have the satisfaction of seeing the high tension satisfactorily subside, with all its accompanying symptoms, and this will take place without using any depressor remedies.

With such a varied pathological cause for the group of morbid symptoms that we call bronchial asthma, is it reasonable to expect that any medicinal course of treatment, either

by the stomach or by inhalation, can ever effect a radical cure, or have any but a passing action? A symptom here and there can be relieved and the patient made more comfortable (*vide* the endless list of patent and proprietary cures that are no cures). As scientific men we should go, if possible, to the roots of the disease, and the modern science of bacteriology is helping us to do this most effectually. We have much to learn, and something to unlearn, but patience and honest work will produce undreamt-of results. Finally, I look on this treatment as a true and logical extension of my dream—organic therapeutics.

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Scott
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